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Economic Analysis of Personal Watercraft Regulations in Fire Island National Seashore

Final Report

Prepared for

**National Park Service
Environmental Quality Division
Dr. Bruce Peacock**

Prepared by

LAW Engineering and Environmental Services, Inc.
3200 Town Point Drive, NW, Suite 100
Kennesaw, GA 30144

ARCADIS JSA
301 East Ocean Blvd.
Long Beach, CA 90802
and
RTI

Health, Social, and Economics Research
3040 Cornwallis Road
Research Triangle Park, NC 27709

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Introduction

Historically, the National Park Service (NPS) classified personal watercraft (PWC) with all other water vessels, which allowed people to use PWC when the use of other vessels was permitted by a Superintendent's Compendium.¹ In recognition of its duties under the Organic Act and NPS Management Policies, as well as increased awareness and public controversy, NPS reevaluated its methods of PWC regulation.

Because of new information regarding potential resource impacts, conflicts with other users, and safety concerns, NPS proposed a PWC-specific regulation in 1998 that PWC would be prohibited in units of the national park system unless NPS determines that PWC use is appropriate for a specific unit based on that unit's enabling legislation, resources, and values; other visitor uses; and overall management objectives (63 CFR 49,312–17, September 15, 1998). During a 60-day comment period, NPS received nearly 20,000 comments on this proposed regulation. As a result of public comments and further review, NPS promulgated an amended regulation in March 2000 allowing NPS to permit PWC use in 11 units by promulgating a special regulation and in an additional 10 units by amending the Superintendent's Compendiums (36 CFR 3.24[b], 2000). The March 2000 regulation provided park units a 2-year grace period in which PWC use could continue after which time PWC would be banned from any park that took no action to

¹A compendium is an NPS management tool used specifically by a park superintendent to take actions to address park-specific resource protection concerns.

promulgate either PWC-specific regulations or to regulate PWC use in the Superintendent's Compendium.

On August 31, 2000, Bluewater Network et al. filed a complaint with the United States District Court for the District of Columbia against NPS alleging, among other things, that the NPS rule-making decisions to allow PWC use in some park units after 2002 by making entries in Superintendent's Compendiums would not provide the opportunity for public input. In addition, the environmental group claimed that because PWC cause water and air pollution, generate noise levels, and pose public safety threats, NPS acted arbitrarily and capriciously when making its September 1998 and March 2000 decisions.

A settlement agreement between NPS and Bluewater Network was signed by the District Court on April 12, 2001. The agreement requires all park units wishing to continue PWC use to promulgate special regulations only after each unit conducts an environmental analysis in accordance with the 1969 National Environmental Policy Act (NEPA). At a minimum, the NEPA analysis must evaluate the impacts of PWC on water quality, air quality, soundscapes, wildlife, wildlife habitat, shoreline vegetation, visitor conflicts, and visitor safety. In addition NPS is required by federal statutes, including Executive Order 12866, to conduct a benefit-cost analysis of the proposed regulation and analyze the impact of the regulation on small businesses under the Regulatory Flexibility Act (RFA) of 1980.

This report describes the results of an analysis of the proposed alternatives for regulating PWC use in Fire Island National Seashore (FIIS), as required by the terms of the April 2001 settlement and by applicable federal statutes. Following a description of the current and proposed regulations, this report presents baseline information about FIIS and current PWC activity. From this baseline, an economic impact analysis for the local economy and a benefit-cost analysis of the alternative scenarios were conducted, as well as an analysis of the impact of the alternatives on small businesses.

1.1 CURRENT PWC ACTIVITIES

In April 2000, the superintendent of FIIS issued a Superintendent's Compendium that allowed the use of PWC (including operating,

transiting, launching, and beaching) anywhere within the FIIS boundaries. Figures 1-1 and 1-2 show the area within FIIS borders as well as the surrounding region for the western and eastern portions of FIIS, respectively. In addition, the Superintendent's Compendium requires PWC users within FIIS to comply with all local, state, and federal regulations regarding PWC use.

1.2 PROPOSED REGULATIONS

1.2.1 Alternative A—Continue PWC Use as Currently Managed under a Special Regulation

Under Alternative A, a special regulation would be adopted to continue the current management and regulation of PWC, as described in Section 1.1, after the grace period expires in April 2002.

The special regulation would continue PWC use indefinitely in all waters within FIIS as described in the April 2000 Superintendent's Compendium. The FIIS boundary extends 1,000 feet offshore into the Atlantic Ocean and up to 4,000 feet into the waters of Great South Bay. All local, state, and national regulations regarding PWC use would remain in effect and would be enforced by NPS.

1.2.2 Alternative B—Continue PWC Use but Limit Areas of Use to Those Areas Adjacent to Beach Communities

Under Alternative B, NPS would promulgate a special regulation to continue PWC use within the waters of FIIS after April 2002 with the following geographical restrictions.

- A. PWC would be prohibited from operating in the following areas:
 - 1. in FIIS waters of Great South Bay between the west boundary of Kismet and the west boundary of FIIS, extending west to the Fire Island Lighthouse;
 - 2. in channels to and from Bellport Beach and Great Gun Beach;
 - 3. in all FIIS waters of Great South Bay between the west boundary of Moriches Inlet and the west boundary of the Sunken Forest, except for those areas used as ferry channels;

Figure 1-1. Map of Fire Island and Surrounding Region (West)



4. in all FIIS Atlantic Ocean areas from the west boundary of Moriches Inlet to the east boundary of Robert Moses State Park;
 5. at the William Floyd Estate; and
 6. within NPS marinas.
- B. PWCs would be allowed to operate in Great South Bay north of the following areas:
1. Moriches Inlet;
 2. in areas west of the west boundary of the Sunken Forest tract and east of the east boundary of the Fire Island Lighthouse area (at Kismet). However, within that area PWCs cannot operate in Clam Pond located in Saltaire and cannot operate within 1,000 feet of East Fire Island and West Fire Island; and

Figure 1-2. Map of Fire Island and Surrounding Region (East)

3. in areas adjacent to the communities of Davis Park, Water Island, Fire Island Pines, and Cherry Grove.

In addition to the geographic restrictions presented in A and B, all local, state, and federal laws and regulations related to PWC use would remain in effect and would be enforced by NPS.

1.2.3 Alternative C—Continue PWC Use But Enforce a 1,000-Foot Buffer Around the Entire Park

Under Alternative C, NPS would promulgate a special regulation to continue PWC use within the waters of FIIS after April 2002 with the following restrictions.

- A. PWCs would be excluded from the same areas as under Alternative B, but face an additional restriction that PWCs are not permitted to operate within 1,000 feet of any shoreline (including smaller islands' shorelines).
- B. PWCs can operate in ferry ways but must maintain a no-wake speed.

In addition to the geographic restrictions presented in A and the no-wake provision in B, all local, state, and federal laws and regulations related to PWC use would remain in effect and would be enforced by NPS.

1.2.4 No-Action Alternative

The no-action alternative would continue present management actions at FIIS (see Section 1.1) until the grace period expires in April 2002. At the end of the grace period, NPS would take no further action to adopt special regulations retaining PWC use, which would result in a ban on PWC within the national seashore boundaries beginning in April 2002.

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Baseline Description of PWC Use in Fire Island National Seashore

FIIS, located parallel to Long Island, New York, is a natural area designated specifically for the preservation of its undeveloped beaches, dunes, and recreational resources. FIIS includes 6,241 acres of federal land and 13,338 acres of nonfederal for a total of 19,579 acres. The island is composed of three distinct areas: a residential area with 17 individual communities, several natural and historical areas, and unspoiled undeveloped beaches and barrier island ecosystem. The island also contains approximately 37 miles of seashore. The federal government owns approximately 30 percent of the island, including FIIS. FIIS' eastern boundary includes Smith Point County Park, and the western boundary is adjacent to Robert Moses State Park (the state park is not within the NPS boundary).

NPS established FIIS in 1964 "for the purpose of conserving and preserving for the use of future generations certain relatively unspoiled and undeveloped beaches, dunes, and other natural features... which possess high values to the Nation as examples of unspoiled areas of great natural beauty in close proximity to large concentrations of urban populations" (Public Law 88-587, Fire Island Act, 1964).

FIIS is managed under a 1977 General Management Plan (GMP), and FIIS contains New York's only federal wilderness area: the 7-mile long Otis Pike Fire Island High Dune Wilderness.

2.1 PWC AREA ACCESS, MAINTENANCE, AND ENFORCEMENT

A detailed description of areas where PWC use is permitted at FIIS is provided in Section 1.1. PWC users can access FIIS in several ways from outside the park, but no public boat ramps are located within FIIS because FIIS contains no public roads. PWC users can access FIIS at marinas located in residential areas (i.e., Ocean Beach) and by landing/launching on undeveloped beaches. Two visitor's centers, Sailor's Haven and Watch Hill, provide an anchorage area for watercraft, this includes PWC but no special accommodations are provided for PWC. These areas provide PWC users access to the national seashore from locations outside the park boundary.

FIIS does not provide any facilities solely for PWC users. The marinas (Sailor's Haven and Watch Hill) are shared with other watercraft, and all park visitors use ferry landings and land-based facilities (i.e., visitor's centers, snack bars). Therefore, maintenance associated with PWC is incidental to other park operational costs.

FIIS personnel issued 14 violations in the past 5 years that involved PWC users. These violations included speeding and operating in restricted areas (e.g., areas designated for swimming). Currently, law enforcement and rescue operations in FIIS waters are conducted with concurrent jurisdiction by NPS and other law enforcement agencies, such as the Suffolk County enforcement agency and the U.S. Coast Guard (NPS, 2002). In this context, the primary laws being enforced are state boating laws and not regulations governing PWC use in PWC-restricted FIIS waters.

Under the proposed regulations (listed in Section 1.2) NPS will have to take a greater role in enforcing PWC use in restricted areas; however, limited staff are available for enforcement activities. Currently, FIIS has two park personnel patrol the park jurisdictional waters. The patrols of the western district include approximately 16 person-hours on Friday, 25 person-hours on Saturday, 26 person-hours on Sunday, and approximately 3 to 4 hours per weekday. NPS staff did not have estimates of weekday patrols for the eastern district but indicated that it is not as patrolled as much as the western district. To provide adequate enforcement for Alternatives B, C, and no action, the park would theoretically need to double the number of personnel to four permanent and four

seasonal in the summer season to enforce the restricted PWC areas. Implementation of Alternatives B, C, and no action will include an educational effort on behalf of the park to inform the PWC users about the restrictions within FIIS' boundaries. This constitutes an additional cost in labor and materials for the park compared to current expenditures.

2.2 VISITATION DATA

2.2.1 FIIS Total Visitation Data

There is no entrance fee at FIIS; therefore, visitation is estimated by FIIS staff based on the number of people using the visitor's centers on the island. FIIS reports an average of 600,000 recreational visitors a year. However, when considering all visitors within the park boundaries, actual visitation could be as high as 3 to 4 million (NPS, 2002). Table 2-1 provides monthly visitation data for 2000. The ferries to and from the park are operated between May and October, the same months in which almost 87 percent of annual visitation occurs.

Private residences are also located within the FIIS boundary. The winter residents number between 300 and 400 people, but the cumulative number of summer residents within FIIS increases to about 80,000 to 100,000. There are approximately 4,000 houses in the private communities. Most of the houses are rented out during the summer months. Vehicles can access Fire Island by two bridges. Robert Moses Causeway allows vehicular access to Robert Moses State Park outside of the FIIS boundary near the western end of the island. The other vehicular access to Fire Island is via the William Floyd Parkway, which ends at Smith Point County Park near the eastern end of the island. These parks have parking (parking fee applies), and Smith Point County Park has camping facilities but no PWC access to the water. No vehicle access to the interior of FIIS is available. FIIS can also be reached by ferries and private boats, with docking available at the local marinas. Water taxis are available for shuttling visitors once on the island.

Table 2-1. Monthly Visitation to FIIS, 2000

Month	Year	Recreation Visits	Nonrecreation Visits	Total Visits
January	2000	11,474	6,363	17,837
February	2000	9,080	21,624	30,704
March	2000	12,964	20,790	33,754
April	2000	11,930	20,280	32,210
May	2000	36,248	20,736	56,984
June	2000	102,329	13,980	116,309
July	2000	157,276	5,325	162,601
August	2000	146,815	3,813	150,628
September	2000	31,585	14,463	46,048
October	2000	45,563	19,221	64,784
November	2000	28,464	20,055	48,519
December	2000	6,605	20,841	27,446
Totals:		600,333	187,491	787,824

Source: National Park Service (NPS). "Visitation Records." <<http://www.nps.gov>>. As obtained in October 2001.

2.2.2 FIIS Watercraft Visitation Data

FIIS has no specific visitation data on the number of PWC users at the national seashore. However, NPS staff conducted an informal survey on Saturdays and Sundays for the month of July 1999. In this study, they counted the number of boats at 2 pm, including PWC, and found the number to be between 200 and 300. PWCs represented approximately 20 percent of the total.

On the north end of the island, several types of recreation boats and fishing boats cross Great South Bay to arrive at Fire Island. Often times the waterways are congested, especially on the side of the island facing Long Island. Within FIIS, boaters typically anchor off the shorelines at the visitor's centers. NPS personnel observe many boaters, including PWC, at FIIS.

Approximately 95 percent of the PWC users are owners (NPS, 2002). The majority of PWC use is localized on the northwest side of the island in the navigation channel and between the smaller islands (West Fire Island and East Fire Island) and the private communities. Many PWC users own or rent houses on Fire Island and use PWC to transit back and forth between the residential areas

and Long Island. Larger boats in Great South Bay also use PWC to transverse from their boats to FIIS, because the bay is shallow. Other PWC users launch their vessels from Great Cove, Long Island, and transit to Kismet, Fire Island, to access restaurants. A PWC livery was operated in past years at Ocean Bay Park, but it is not known if the livery currently rents PWC that travel to FIIS. Retail shops that sell and service PWC are located on Long Island. The Atlantic Ocean within the FIIS boundary is not a popular PWC recreational area because of the long travel distance from FIIS inlets to the ocean side of the island. PWC use of FIIS on the Atlantic Ocean is limited to the few (approximately six) people each year who push their PWCs across the dunes, without vehicles, to the Atlantic Ocean (NPS, 2002).

2.3 ALTERNATE LOCATIONS FOR PWC USE NEARBY

Areas along the Long Island shoreline that allow PWC use include: Great Cove, Babylon, Nicoll Bay, Patchogue Bay, Bellport Bay, Mastic Beach, Moriches Bay, South Oyster Bay, and the Great South Bay outside of FIIS' boundary. The greatest concentration of PWC users is currently in Great Cove and Nicoll Bay (Connetquot River). Although these areas listed above are alternative areas for PWC use, many of the PWC users at FIIS use their personal PWC to transit between FIIS and Long Island, to access larger boats, or in the area near their communities, so the areas listed above are not strictly comparable.

2.4 OTHER MAJOR SUMMER ACTIVITIES IN FIIS

Summer recreation activities in FIIS include canoeing, kayaking, shell collecting, hiking, bicycling, backpacking, bird watching, boating, star gazing, wildlife viewing, camping, marinas, ocean beaches, bathhouses, nature trails, educational programs, lighthouse tours, history talks, and museums (NPS brochure, undated). The area encompasses a wide variety of ecological conditions and offers numerous species of wildlife for visitors to see during their visit. Bird watching is popular in the Sunken Forest, a 300-year-old holly forest. In addition, NPS presents educational programs at the seashore. Tours are often conducted at the lighthouse tower and at

the historic William Floyd Estate. Guided walks include explorations of bird life, the beach, salt marshes, the bay, and dunes. The visitor's centers located at Sailor's Haven and Watch Hill on the island have an interpretive center and offer historic and recreational island information.

Fishing for saltwater species, canoeing, swimming, and taking ferry rides are popular activities in FIIS' boundary that may come into direct conflict with PWC use. Many of the anglers operate motorized watercraft in some of the same areas where PWC are used. Fishing is most common during the morning hours, whereas PWC use often occurs later in the day. PWC are not allowed in the designated swimming areas; however, some violations have been observed. Furthermore, ferry boat captains have complained about the PWC drivers cutting in front of the ferries or jumping the ferries wake.

2.5 NATURAL RESOURCES AND LIKELY ECOLOGICAL IMPACTS OF PWC USE IN PARK

The following section provides key information relating to natural resources at FIIS and an assessment of the likely magnitude of impacts to park resources under several proposed PWC management alternatives. Interviews with FIIS personnel and data from a U.S. Army Corps of Engineers (USACE) draft environmental impact statement (EIS) for FIIS beach renourishment (USACE, 1999) provide the basis for this analysis. Impacts were assessed using current conditions as the baseline and comparing them with the proposed alternatives (see Section 1).

2.5.1 Water Quality

Most research on the effects of PWC use on water quality focuses on the impacts of two-stroke engines and assumes that impacts caused by these engines also apply to the PWC powered by them. The typical conventional (i.e., carbureted) two-stroke PWC engine intakes a mixture of air, gasoline, and oil into the combustion chamber, expels exhaust gases from the combustion chamber, and discharges as much as 30 percent of the unburned fuel mixture as part of the exhaust (California Air Resources Board, 1999). At

common fuel consumption rates, an average 2-hour ride on a PWC may result in the discharge of 3 gallons (11.34 liters) of fuel into the water (VanMouwerik and Hagemann, 1999).

Contaminants released into the environment due to PWC use include those present in the raw fuel itself and those that are formed during its combustion. Fuel used in PWC engines contains many hydrocarbons (HCs), including volatile organic compounds (VOCs) such as benzene, toluene, ethylbenzene, and xylene (collectively referred to as BTEX) and methyl tertiary butyl ether (MTBE). Unburned PWC fuel does not contain appreciable levels of polycyclic aromatic HCs (PAHs), but several PAHs are formed as a result of its combustion (i.e., phenanthrene, pyrene, chrysene/benzo(a)pyrene, and acenaphthylene) (VanMouwerik and Hagemann, 1999). Other HCs that are not present in PWC fuel but are by-products of incomplete combustion include formaldehyde, acetaldehyde, diesel particulate matter (PM), and 1,3-butadiene (EPA, 1994).

Unburned fuel and combustion by-products are released to the environment in PWC exhaust. Because of differences in chemical and physical characteristics, BTEX released into the water readily transfers from water to air, whereas most PAHs and MTBE do not. Therefore, water quality issues associated with BTEX in the water column are less critical than those associated with PAHs and MTBE (VanMouwerik and Hagemann, 1999).

Compounds released in water due to PWC use are known to cause adverse health effects to humans and aquatic organisms. Exhaust emissions from 2 stroke engines have been specifically shown to cause toxicological effects in fish (Tjarnlund et al., 1995, 1996; Oris et al., 1998). Sunlight can further increase the toxic effect of PAHs to aquatic organisms (Mekenyan et al., 1994; Arfsten et al., 1996). Research evaluating the possible phototoxic effects of some PAHs to aquatic organisms (NCER, 1999) has demonstrated that toxicity may vary due to a number of factors, including length of exposure; turbidity, humic acid, and organic carbon levels; the location of the organism relative to the surface of the water or the sediment; and weather/PAH fate issues (NCER, 1999). For instance, increased turbidity or organic carbon tended to reduce toxicity, increasing the length of exposure tended to increase toxicity, and proximity to the surface might increase toxicity (i.e., shallow waters).

New PWC engines, including direct-injected two-stroke engines and four-stroke engines, will decrease the amount of unburned fuel that escapes with PWC exhaust and will result in decreases in emissions (VanMouwerik and Hagemann, 1999). As a result of EPA's 1996 rule requiring cleaner running spark-ignited marine engines¹, a 50 percent reduction of current HC emissions from these engines is expected by 2020, and a 75 percent reduction in HC emissions is expected by 2025 (EPA, 1996b).

Baseline Water Quality Conditions at FIIS

FIIS follows New York State's water quality standards. Great South Bay, the waterbody between FIIS and Long Island, is included on the New York State Department of Environmental Conservation (NYDEC) priority waterbodies list. This list contains water quality impacted and threatened waterbody segments. The primary source of pollution for Great South Bay is urban runoff (South Shore Estuary Reserve Council, 2002). Sediments, nutrients, and coliform bacteria are the primary pollutants.

The U.S. Geological Survey (USGS), NY DEC, and NPS have conducted water quality studies. However, NPS does not know of any particular water quality study in the Great South Bay that specifically addresses PWC pollutants. Water quality may affect terrestrial and aquatic wildlife, which is discussed in Section 2.5.4.

Potential Impact of PWC Use on Water Quality Under the Proposed Alternatives

Alternative A—Continue PWC Use as Currently Managed under a Special Regulation. No improvements to water quality are anticipated under this alternative relative to baseline, with the exception of gradual improvements associated with a transition away from inefficient conventional two-stroke engines to EPA-compliant direct-injected two-stroke or four-stroke models.

Alternative B—Continue PWC Use but Limit Area of Use To Those Areas Adjacent to Beach Communities. Impacts under this

¹ In 1996, the United States Environmental Protection Agency (EPA) promulgated a rule to control exhaust emissions from new spark-ignition marine engines, including outboards and PWC. Emission controls provide for increasingly stricter standards beginning in model year 1998, with all PWC manufactured after 2006 required to be EPA emissions compliant (i.e., to reduce HC emissions by 75 percent from unregulated levels) (EPA 1996b).

alternative are expected to be similar to Alternative A, except that there may be beneficial impacts on water quality by restricting the offshore areas and NPS beach areas that PWC are allowed to access. However, PWC use would more likely be concentrated in the beach communities and exacerbate impacts in more localized areas. Overall, given the small amount of PWC use relative to other watercraft and the fact that other stressors affect local waters, we do not anticipate any noticeable change in water quality.

Alternative C—Continue PWC Use but Enforce a 1,000-Foot Buffer Around the Entire Park. This alternative would have similar impacts on water quality as Alternative B with the following exception. Water quality close to shore may improve by limiting the access areas to the island to the existing ferry channels. PWC would be required to operate at a no-wake speed in the ferry channels, which would improve water quality close to shore.

No-Action Alternative. Banning PWC under this alternative would result in the elimination of all PWC-related emissions within FIIS. This may result in some improvement of water quality, but this improvement would likely be limited because other stressors, including urban run-off and other motorized vessels, would continue to affect water quality.

2.5.2 Air Quality

Air quality and visibility can be affected by emissions from two-stroke engines such as PWC motors. Emissions from PWC in national parks are one of many potential (albeit, relatively small) sources of these air quality and visibility impairments.

Recreational marine engines, including PWC and outboard motors, contribute approximately 30 percent of national nonroad engine emissions and are the second largest source of nonroad engine HC emissions nationally (EPA, 1996a). According to the results of a 1990 inventory of emissions in California, watercraft engines were estimated to account for 141 tons of smog-forming reactive organic gases (ROG), 1,063 tons of carbon monoxide (CO), and 31 tons of nitrogen oxides (NO_x) emitted per day (Kado et al., 2000). A study comparing emissions from conventional and direct-injected two-stroke engines with four-stroke engines found that the new four-stroke engine has considerably lower emissions of PM, PAHs, and

genotoxic activity (Kado et al., 2000). Based on a comparison with a typical 90-horsepower engine it is estimated the ban of conventional two-stroke engines would result in a four-fold decrease in smog-forming pollution per engine (VanMouwerik and Hagemann 1999).

Although PWC engine exhaust is usually routed below the waterline, a portion of the exhaust gases pollute the air. Up to one-third of the fuel delivered to conventional two-stroke engines goes unburned and is discharged as gaseous HCs; the lubricating oil is used once and is expelled as part of the exhaust; and the combustion process results in emissions of air pollutants such as HCs (including VOCs [e.g., BTEX and MTBE] and PAHs), NO_x , PM, and CO (Kado et al., 2000). PWC also contribute to the formation of ozone (O_3) in the atmosphere, which is formed when HCs react with NO_x in the presence of sunlight (EPA, 1993). (See Section 2.5.1 for further discussion of burned and unburned constituents of PWC emissions.)

These compounds are known to cause adverse effects to both human and plant life. They may adversely impact park visitor and employee health, as well as sensitive park resources. O_3 causes respiratory problems in humans, including cough, airway irritation, and chest pain during inhalations. O_3 is also toxic to sensitive species of vegetation. It causes visible foliar injury, decreases plant growth, and increases plant susceptibility to insects and disease (EPA, 1993).

CO can interfere with the oxygen-carrying capacity of blood, resulting in lack of oxygen to tissues. NO_x and PM emissions associated with PWC use can also degrade visibility. Adverse health effects have been associated with airborne PM, especially less than $10\ \mu\text{m}$ aerodynamic diameter (PM₁₀) (Kado et al., 2000). NO_x also contributes to acid deposition effects on plants, water, and soil.

Baseline Air Quality Conditions at FIIS

FIIS is located in Suffolk County, New York, an area classified by EPA as a nonattainment area for ozone, meaning that national ambient air quality standards are not met for ozone. PWC use within the park is only a small contributor to air pollution in the

area because of its close proximity to New York City and Long Island. PWC activity is concentrated on both the east and west ends of FIIS. Overall, the air quality tends to be worse in marinas than in the rest of FIIS (USACE, 1999). NPS is concerned about smog because of the close proximity of FIIS to New York City and Long Island.

Potential Impact of PWC Use on Air Quality Under the Proposed Alternatives

Alternative A—Continue PWC Use as Currently Managed under a Special Regulation. No changes in air quality relative to baseline are anticipated under this alternative. Improvements to air quality from reduced emissions are likely to be gradual as manufacturers meet EPA requirements to improve the efficiency of engines by the year 2006 and conventional engines are replaced with direct-injected two-stroke or four-stroke models.

Alternative B—Continue PWC Use But Limit Area of Use to Those Areas Adjacent to Beach Communities. Implementation of this alternative is unlikely to benefit or impair air quality compared to baseline because PWC are a small contributor to overall regional impacts on air quality. However, because PWC use would be concentrated in nearshore community areas, air quality in those areas could potentially decrease. However, given the relatively small contribution of PWC to regional air quality, it is unlikely that there would be any noticeable change in air quality in the nearshore communities. Although this alternative does not require EPA-compliant engines, it is anticipated that, as the industry standard for PWC engines changes, cleaner direct-injected two-stroke and four-stroke engines would become the standard and emissions would likely decrease.

Alternative C—Continue PWC Use but Enforce a 1,000-Foot Buffer Around the Entire Park. This alternative would have similar impacts on air quality and visibility as Alternative B with the following exception. Air quality close to shore in areas with high shoreline and watercraft traffic may improve, particularly where PWC use will be restricted in areas where they currently frequent the shoreline. However, as described above, given regional air quality issues, this alternative is not likely to impair or improve overall air quality.

No-Action Alternative. The no-action alternative could have minor beneficial effects on air quality because PWC-related emissions would be eliminated from FIIS. However, as described above, given regional air quality issues, implementation of this alternative is not likely to improve air quality.

2.5.3 Soundscapes

One aspect of experiencing the resources in national parks is the ability to hear the sounds associated with its natural resources, often referred to as “natural sounds” or “natural quiet.” Natural quiet generally includes the naturally occurring sounds of winds in the trees, calling birds, and the quiet associated with still nights. “Noise” is defined as unwanted sound. Sounds are described as noise if they interfere with an activity or disturb the person hearing them.

PWC emit up to 105 dB per unit at 82 feet, which may disturb park users (visitors and residents). NPS has established a noise limit of 82 dB at 82 feet. Noise from PWC may be more disturbing than noise from a constant source at 90 dB due to rapid changes in acceleration and direction of noise (EPA, 1974) and their ability to be driven in shallow water close to the shoreline. However, the newer, compliant models of PWC may be up to 50 to 70 percent quieter than the older models (PWIA, 2002).

Baseline Soundscape Conditions at FIIS

There are no specific noise measurements for PWC at FIIS. The levels of sounds generated by watercraft using FIIS are expected to affect recreational users differently. Therefore, impacts to soundscapes must consider the effect of noise levels on different types of recreational users within the study area. Park personnel have stated that people on the nature trails within FIIS can hear other noises such as low flying airplanes and noise from the marinas and campgrounds. These noises and the communities within FIIS do not give the island a pristine soundscape.

Potential Impact of PWC Use on Soundscape Under the Proposed Alternatives

Alternative A—Continue PWC Use as Currently Managed under a Special Regulation. No changes to the soundscape are anticipated

under Alternative A relative to baseline. However, it is anticipated that, as the industry standard for PWC engines changes, quieter PWC will become the standard and noise from PWC will decrease.

Alternative B—Continue PWC Use but Limit Area of Use Under a Special Regulation. Impacts under this alternative are expected to be similar to Alternative A, except that reductions in PWC-generated sounds may occur in some areas where PWC use is limited. However, ambient noise such as boat traffic and community noise (not including vehicles) means this reduction in noise is not likely to be noticeable. Moreover, PWC density adjacent to shoreline communities may increase, thus increasing the noise in these localized areas. It is anticipated that, as the industry standard for PWC engines changes, quieter PWC will become the standard and noise from PWC will decrease.

Alternative C—Continue PWC Use but Enforce a 1,000-Foot Buffer Around the Entire Park. This alternative would be similar to Alternative B although reductions in noise would likely be greater on the shoreline, in beach communities, and in nearshore areas. However, overall improvements to the soundscape will likely be minimal because of ambient noise levels.

No-Action Alternative. This alternative will eliminate the impact of PWC use on the soundscape. However, improvements to the soundscape will probably be minimal because of other ongoing activities that contribute to ambient noise.

2.5.4 Wildlife and Wildlife Habitat

PWC may affect wildlife by interrupting normal activities, inducing alarm or flight responses, causing animals to avoid habitat, and potentially affecting reproductive success. These effects are thought to be caused by a combination of PWC speed, noise, and ability to access sensitive areas, especially in shallow water (WDNR, 2000). PWC potentially can access sensitive shorelines and disrupt riparian habitats critical to wildlife. When run in very shallow water, PWC can disturb the substrate, including aquatic plants, benthic invertebrates, and, at certain times of year, fish breeding and nursery areas. Furthermore, water quality degradation caused by PWC can affect migratory avian species in the area.

Waterfowl and nesting birds may be particularly sensitive to PWC because of their noise, speed, and unique ability to access shallow water. This may force nesting birds to abandon eggs during crucial embryo development stages, keep adults away from nestlings, thereby preventing them from defending the nest against predators, and flush other waterfowl from habitat, causing stress and associated behavior changes (WDNR, 2000; Burger, 1998; Rodgers and Smith, 1997).

Baseline Wildlife and Wildlife Habitat Conditions at FIIS

Wildlife habitat at FIIS consists of relatively unspoiled seashore and undeveloped beaches, dunes, maritime forests, salt marshes, and the Otis Pike Wilderness area, which is the only designated federal wilderness area in the state of New York. The Sunken Forest (maritime community) is a preserve containing a 300-year-old holly forest. The bayside beach at Otis Pike Wilderness area does not experience much PWC use. The shore during low tide is mucky, with tree stumps and eelgrass that make it an undesirable area for PWC users (NPS, 2002). No studies have been conducted on the effects of PWC on wildlife or wildlife habitat at FIIS.

Marine Life

Benthic invertebrates, shellfish, crustaceans, and finfish are located near shore. Benthic invertebrates are dominated by digger amphipods, polychaete worms, dwarf tellin, near nut shell, and isopods. Shellfish primarily consist of surf clams and black clams. Crustaceans include lobster, rock crab, spider crab, and lady crab. Finfish consist of tautog, cunner, windowpane, and little skate. Transient species include Atlantic silverside, rough silverside, striped anchovy, bay anchovy, northern kingfish, bluefish, spot, northern puffer, striped bass, weakfish, summer flounder, blueback herring, hickory shad, alewife, American shad, and butterfish. A total of 15 finfish species have been reported to spawn in the near-shore habitat. Dominant species reported in the area are the four-beard rockling, Atlantic silversides, rough silversides, bay anchovy, Atlantic menhaden, tautog, black seabass, and conger eels (USACE, 1999). Intertidal zone species consists of beach flea amphipod, mole crab and polychaete worms, amphipods, and lady crabs (USACE, 1999).

Currently, there are no known impacts to marine life as a result of PWC use at FIIS.

Plants

Dune and swale community vegetation consists of common saltwort, seaside spurge, sea rocket, beach grass, dusty miller, beach-pea, beach plum, bayberry, Virginia creeper, poison ivy, bearberry, black cherry, seaside goldenrod, beach-heather, pitch pine, eastern red cedar, winged sumac, highbush blueberry, and American holly (USACE, 1999).

The maritime forest community (i.e., the Sunken Forest) includes eastern red cedar, pitch pine, black cherry, winged sumac, and American holly, sassafras, serviceberry, and highbush blueberry. Freshwater bogs within the maritime forests have a high presence of acidic humus layer at the ground surface. Shrub species is dominated by honeysuckle and highbush blueberry. Herbaceous species include St. John's wort, cinnamon fern, royal fern, and marsh shield-fern (USACE, 1999).

Currently, there are no known impacts to plants as a result of PWC use at FIIS.

Birds

FIIS has many bird species that use the Fire Island barrier for foraging, resting, nesting, and breeding. The area also lies within the Atlantic Flyway, an important migratory route for many shorebirds. Thirty-seven species of resident and migratory birds have been recorded at FIIS. Common species include gulls, yellowlegs, and willets. Raptors observed in the area include hawks, turkey vultures, bald eagles, and owls (USACE, 1999).

Currently, there are no known impacts to birds as a result of PWC use at FIIS.

Mammals

Many mammals have been observed at FIIS. Some of these species include whitetail deer, eastern cottontail, red fox, raccoon, masked shrew, short-tailed shrew, muskrat, and mink (USACE, 1999).

Currently, there are no known impacts to mammals as a result of PWC use at FIIS.

Reptiles and Amphibians

Eight reptile and one amphibian species have been identified within FIIS. These include fowler's toad, eastern mud turtle, spotted turtle, northern diamondback terrapin, snapping turtle, eastern box turtle, eastern hognose snake, eastern garter snake, and northern black racer (USACE, 1999).

Currently, there are no known impacts to reptiles and amphibians as a result of PWC use at FIIS.

Potential Impact of PWC Use on Wildlife Habitat Under the Proposed Alternatives

Alternative A—Continue PWC Use as Currently Managed under a Special Regulation. No improvements to wildlife or wildlife habitats are anticipated under this alternative relative to baseline, with the exception of gradual water quality improvements associated with a transition away from conventional two-stroke engines to EPA-compliant direct-injected two-stroke or four-stroke models.

Alternative B—Continue PWC Use but Limit Area of Use to Those Areas Adjacent to Beach Communities. Compared to baseline conditions, this alternative may have some beneficial impact on wildlife (e.g., waterfowl and fish) and wildlife habitat by restricting the offshore areas, smaller islands, and NPS beach areas that PWC currently are allowed to use. However, PWC use would likely be more concentrated in the beach communities, making emissions in these localities more concentrated than in the wilderness areas. Overall, given the small amount of PWC use relative to other watercraft and the fact that other stressors affect the local waters we do not anticipate any noticeable change in the beach community areas.

Alternative C—Continue PWC Use but Enforce a 1,000-Foot Buffer Around the Entire Park. This alternative would have similar impacts on wildlife and wildlife habitat as Alternative B with the following additional benefit. Water quality close to shore may improve by limiting the island's access areas to the existing ferry

channels, which see a lot of watercraft use. The PWC would be limited to no-wake zones in the ferry channels, which would benefit water quality close to shore. The resulting improvement in water quality may benefit animals (e.g., waterfowl, other birds, fish) and plants in the shore region, although the effects are likely to be fairly small because motorized vessels other than PWC and urban runoff would continue to affect water quality.

No-Action Alternative. Banning PWC under this alternative would eliminate all PWC-related emissions within FIIS. Eliminating emissions may result in some improvement of wildlife and wildlife habitat, but this improvement would probably be limited because other stressors, including urban run-off and other motorized vessels, would continue to affect water quality.

2.5.5 Threatened, Endangered, and Special Concern Species

PWC may affect threatened, endangered, and special species of concern in the same manner they affect wildlife such as by disrupting or degrading the quality of habitat, interrupting normal activities, inducing alarm or flight responses, causing animals to avoid habitat, and potentially affecting reproductive success.

Baseline Conditions of Threatened, Endangered, and Special Concern Species at FIIS

According to the U.S. Fish and Wildlife Service, several federally listed species, including the piping plover, roseate tern, seabeach amaranth, peregrine falcon, loggerhead sea turtle, green sea turtle, leatherback sea turtle, Kemp's Ridley sea turtle, and hawksbill sea turtle have been documented in the vicinity of the PWC open-use areas. Concerns associated with individual species are discussed below.

Birds

Piping plover nesting areas are located at several locations, including Fire Island East, Fire Island Pines, the Sunken Forest, and Otis Pike Wilderness Area. Piping plovers frequent intertidal portions of beaches, washover areas, mudflats, sandflats, wrack lines, and shorelines of coastal ponds or salt marshes to feed.

Roseate terns nest on coastal islands but have not been observed in the study area.

Reaction of various nesting bird species to nearby PWC use indicates that PWC can cause alarm or flight responses and in some cases, the abandonment of nests (NPS, 2002). Piping plovers must maximize their foraging when certain invertebrate prey species are available. For birds raising offspring or building up fat reserves for migration, being flushed from feeding areas could affect the birds' potential for survival, especially when these disturbances continue for several days. NPS staff have observed piping plovers and roseate terns displaying defensive responses (flight and abandonment of nest) to PWC noise near their nesting areas.

Plants

Seabeach amaranth is an annual plant found along the beaches often in inlets and storm washouts (USACE, 1999). PWC's wake action and their landing in seabeach amaranth habitat can negatively affect these plants.

Reptiles

Sea turtles do not have nesting/breeding areas within FIIS. These species only transit within the FIIS boundary. However, PWC could pose a threat to sea turtles swimming within FIIS due to the potential for collisions with PWC moving at high speeds.

Potential Impact of PWC Use on Threatened and Endangered Species Under the Proposed Alternatives

Alternative A—Continue PWC Use as Currently Managed under a Special Regulation. No improvements to threatened and endangered species or their habitats would occur under Alternative A relative to baseline.

Alternative B—Continue PWC Use but Limit Areas of Use to Those Areas Adjacent to Beach Communities. Compared to baseline conditions, this alternative may have some beneficial impact on threatened and endangered species and their habitat by restricting access in the offshore areas, on smaller islands, and along NPS beaches. Piping plover and roseate tern would be protected in the waters adjacent to small islands and wilderness areas established

within FIIS. Overall, given the small amount of PWC use relative to other watercraft and the fact that other stressors affect the local waters, we do not anticipate any noticeable change in the beach community areas.

Alternative C—Continue PWC Use, but Limit Area of Use under a Special Regulation and Implement Other Management Restrictions.

This alternative would have similar impacts on threatened and endangered species and their habitats as Alternative B but would further reduce the potential of PWC to disturb piping plover or roseate terns by imposing a 1,000-foot buffer around the entire park and limiting PWC use to the ferry channels, thus eliminating sources for noise and disturbance from the shore and small islands.

No-Action Alternative. Eliminating PWC use within FIIS would ensure that no impacts to threatened and endangered species would occur as a result of PWC use within park boundary. Banning PWC under this alternative would result in the reduction in noise levels, wave action, and other disturbances associated with PWC-related activities within FIIS. This alternative may improve habitat quality for threatened and endangered species; however, this improvement would probably be limited because of water quality, air quality, and noise associated with other sources.

2.5.6 Shorelines and Shoreline Vegetation

PWC use can potentially adversely affect the shoreline habitat including the shoreline, shoreline vegetation, and submerged aquatic vegetation (SAV) beds. Shoreline and shoreline vegetation are critical to the juvenile stages of fish and general overall habitat for a variety of aquatic organisms, including fish and shellfish, and waterfowl species. SAV beds are also critical to aquatic organisms. SAV beds reduce wave action, support nursery fish, provide protection from predators, stabilize sediment, and provide food for many species.

PWC can affect shoreline and shoreline vegetation because they are able to access areas where most other watercraft cannot go due to their shallow draft. As a result, PWC may land on the shoreline allowing visitors to access and disturb areas where sensitive plant species exist. In addition, wakes created by PWC may cause erosion and thus affect shorelines. Turbulence from boat propellers

near the shoreline can also erode the shoreline by destabilizing the bottom (WDNR, 2000).

PWC use can also affect SAV by increasing turbidity, which may result in decreased sunlight available for SAV, may limit vegetation growth, and ultimately decrease water quality. PWC use in shallow water supporting SAV may reduce its value as important habitat for animals by redistributing the plants and organisms that use these grasses for habitat.

Baseline Condition of Shorelines and Shoreline Vegetation at FIIS

Shoreline vegetation and SAV beds have been identified at FIIS. SAV beds at FIIS are dominated by eelgrass, while the intertidal marshes are dominated by marsh cordgrass. These areas support ribbed mussels and serve as a nursery habitat for small forage fish species. They also provide habitat for various diving and dabbling ducks, as well as the diamondback terrapin, muskrat, and raccoon (USACE, 1999).

The impact of PWC use on shoreline and shoreline vegetation near the beach communities is thought to be minimal because of the small amount of PWC use compared to other watercraft and because many of these areas have bulkhead barriers along the shoreline that have changed the habitat of the shoreline vegetation and SAV beds.

PWC are thought to affect shoreline vegetation (e.g., eel grass beds, intertidal marshes) and shoreline in less developed areas of FIIS. However, the impact is thought to be very minimal because PWC users do not commonly access areas with eelgrass beds because it can damage their engines.

Potential Impact of PWC Use on Shoreline and Shoreline Vegetation Under the Proposed Alternatives

Alternative A—Continue PWC Use as Currently Managed under a Special Regulation. No changes to shoreline or shoreline vegetation relative to baseline are anticipated under this alternative.

Alternative B—Continue PWC Use but Limit Areas of Use to Those Areas Adjacent to Beach Communities. Impacts under this

alternative are expected to be similar to Alternative A, except that improvements in shoreline and shoreline vegetation may occur sooner in the small islands' (within FIIS' boundary) shorelines and the designated wilderness areas within FIIS because regulations would limit PWC use there.

Alternative C—Continue PWC Use But Enforce a 1,000-Foot Buffer Around the Entire Park. This alternative would have similar impacts on submerged vegetation as Alternative B with the following exception. This alternative would further minimize the potential for disturbing submerged vegetation near the shore by restricting PWC use to the ferry channels, thus eliminating sources for physical disturbance from the shore and small islands.

No-Action Alternative. Banning PWC under this alternative would ensure that PWC-related activities within FIIS would no longer affect SAV communities and shoreline vegetation.

2.6 ECONOMIC ACTIVITY IN THE SURROUNDING COMMUNITIES

Several small communities on Fire Island (both inside and outside FIIS) rely heavily on tourism for their economic base. The population of FIIS increases from about 300 to 400 year-round residents in the winter to between 80,000 and 100,000 people in the summer. This increase is primarily due to homeowners and people renting private homes that live or vacation in FIIS during the summer months. Some of these visitors use PWC for recreation and/or transportation. For example, NPS personnel identified Kismet as a destination for many PWC users from Bay Shore or Islip, Long Island. PWC users often transit to Kismet for dinner and then return to Long Island. In addition, many of the residents (both permanent and seasonal) use PWC to reach larger boats or for travel to Long Island because vehicular access is limited in FIIS (there are almost no roads on Fire Island). However, no data are available on the proportion of visitors that currently use PWC. Two marinas in FIIS are frequented by PWC users, but they are also used by boaters and other users, and no data are available that breaks down visitation by type of watercraft.

According to local FIIS staff, about 95 percent of local PWC users are believed to be using private machines rather than rentals. NPS

identified 15 PWC dealerships and rental shops in the vicinity of FIIS. NPS identified 14 PWC dealerships in southern Long Island near FIIS and one PWC rental shop in the Hampton area. An additional rental shop was previously operating within Ocean Bay Park on FIIS, but it did not open during the 2001 season and is believed to be out of business. NPS attempted to contact each of these businesses during January 2002 and successfully collected interview data from seven PWC dealerships.

Based on comments received from these PWC dealerships, between 30 and 90 percent of their customers go to FIIS. PWC are sold year-round with the majority of the sales in the late spring/early summer. Most sales are to local residents, who replace their PWC approximately every 3 years, on average, for newer models. Each business interviewed also serviced PWC. They estimated that the typical PWC owner spends around \$200 per year on maintenance. Interview data suggest that the PWC dealerships near FIIS have other sources of revenue besides PWC sales. These sources include selling motorcycles, boats, snowmobiles, motor scooters, all-terrain vehicles (ATVs), trailers, generators, and outboard motors. Although none of the dealerships interviewed sold PWC exclusively, each implied that their business would be affected under at least one of the alternatives that restrict PWC usage in FIIS. For Alternatives B and C, the dealerships interviewed estimated PWC revenue losses between zero and 50 percent. Under the no-action alternative, these dealerships expected to be much more severely affected. They estimated PWC revenue losses of between 50 and 100 percent. The one rental shop identified in the area was not successfully contacted, but it is several miles north of FIIS and most likely does not rely heavily on renters traveling to FIIS because many alternative areas are available in the vicinity of this shop. NPS does not anticipate significant impacts on this shop.

In addition to businesses offering PWC sales and service or rental services, the proposed restrictions could affect lodging establishments, restaurants, gas stations, and retail stores in the area. These establishments could be affected if the proposed restrictions lead to changes in visitation to the park and surrounding area. Because PWC users constitute an extremely small fraction of visitors to Long Island and viable substitute locations for PWC use are located nearby, it is very unlikely that there will be any measurable

impacts on Long Island's tourist industry. To the extent that people reduce visitation to FIIS because it is more difficult to access, there may be some reduction in economic activity in FIIS and the surrounding area. However, interview data suggest that most PWC users in FIIS own homes on the island, which suggests they would be unlikely to stop visiting the area. In addition, three property rental agencies on Fire Island were interviewed and each indicated that they anticipated no impact on their business associated with restrictions on PWC use. Thus, it is believed that there will be little or no change in visitation to Fire Island even if PWC use is banned in FIIS.

3

Economic Impact Analysis of Restricting PWC Use in Fire Island National Seashore

Riding PWC is a popular recreational activity along beaches near Long Island, New York. In addition, PWC serve as an important form of transportation for some people on the local islands because many other forms of transportation (e.g., automobiles) have only limited access to the area. PWC are used not only for transportation within and between the local islands, but they are also used by some people to travel between their homes and larger boats that they own. Boat owners often cannot dock large boats in the immediate vicinity of their homes because the water adjacent to many of the communities is too shallow. Because there are no roads on the interior part of the island, some of these boat owners may use PWC to reach their boats. Interview data suggest that most PWC activity in FIIS is by local residents who own vacation homes located on the island. NPS identified only one PWC rental shop in the vicinity of FIIS, and this business is believed to be sufficiently far away from FIIS such that it will not realize negative impacts as a result of PWC restrictions in FIIS.

Information is insufficient to accurately estimate the number of PWC-using visitors to the region surrounding FIIS that would stop visiting the region following implementation of PWC regulations in FIIS. However, the lack of PWC rental activity in FIIS suggests that

PWC use is not a significant factor in tourist visitation to the island. Thus, it appears very unlikely that a significant number of people from outside the region would stop visiting the area as a result of the new restrictions on PWC. In addition, interviews with property rental agencies serving the communities on Fire Island indicate that PWC use is not a popular activity among visitors to these communities. All three property rental agencies contacted by NPS indicated that banning PWC in FIIS would have no impact on their business.

Given the small expected change in the number of PWC users traveling to the region, especially relative to total visitation to the Long Island area, NPS expects that the proposed regulations will have no noticeable impact on the total number of visitors to the region. Thus, overall revenues of lodging establishments, restaurants, and other businesses in the Long Island region are unlikely to be significantly affected. To the extent that reduced access to Fire Island reduces visitation, tourism-related businesses located on the island may experience localized impacts. However, it seems likely that most homeowners and renters who currently vacation there would continue to visit unless the inconvenience of using alternative forms of transportation is so great that they choose to stop vacationing on Fire Island. Overall, NPS expects no measurable impact on the regional economy, but it is possible that communities located on Fire Island may experience localized impacts.

Although NPS anticipates no measurable regional economic impact due to the PWC regulations, it is very likely that PWC dealerships will see a decrease in revenue, especially under the no-action alternative. According to local PWC dealerships, several substitution possibilities for PWC use are located outside the park. Thus, it is expected that PWC users who are no longer willing or able to ride in FIIS following the change in regulations will likely continue to use PWC, but may shift some of their recreational PWC use to other locations within the region. This substitution may somewhat mitigate reductions in sales of PWC for recreational use. However, PWC are also used extensively by vacation homeowners and renters for transportation around Fire Island and between Long Island and Fire Island. If PWC could no longer be used for these

purposes, there would probably be a significant decline in PWC sales in southern Long Island.

NPS attempted to interview all of the sales and rental shops identified in the area to gain additional insight into the potential impacts on those businesses. Because NPS conducted this analysis during January 2002, many of the area businesses related to PWC were closed. Consequently, only seven PWC dealerships were contacted successfully. The PWC dealerships generally expressed some concern that any restriction in PWC use could cause a reduction in sales as a result of negative publicity. Under Alternatives B and C, the dealerships interviewed reported expected reductions in revenue of between 0 and 50 percent. All of the sales shops predicted significant declines in sales as a result of the no-action alternative, ranging from 50 to 100 percent reductions in revenue. These impacts are discussed in more detail in Section 5.

4

Benefit-Cost Analysis of the Alternative Regulations

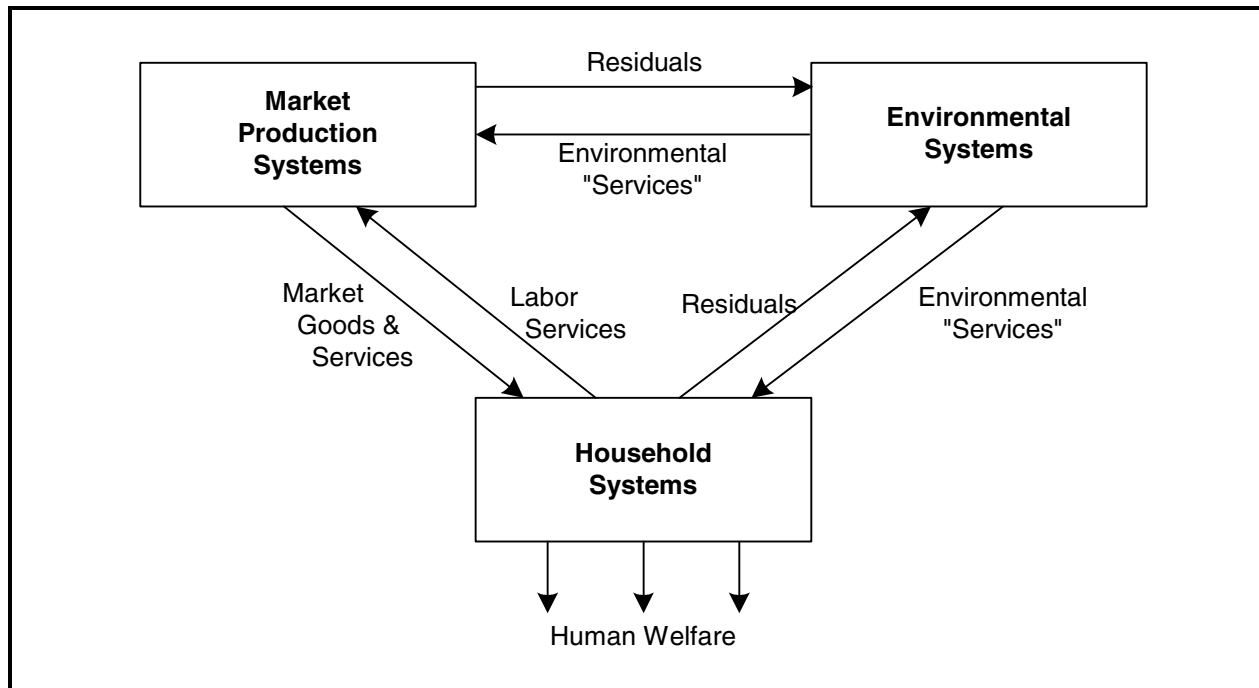
The purpose of benefit-cost analysis is to evaluate the social welfare implications of a proposed action—in this case the regulation of PWC use in national parks. It examines whether the reallocation of society's resources resulting from the action promotes efficiency. That is, it assesses whether the action results in benefits (gains in social welfare) greater than the associated costs to society (losses in social welfare).

4.1 CONCEPTUAL BASIS FOR BENEFIT-COST ANALYSIS OF PWC RESTRICTIONS IN NATIONAL PARKS

According to the conceptual underpinnings of benefit-cost analysis, all social welfare impacts ultimately accrue to individuals. This is represented in Figure 4-1, which depicts flows of goods, services, and residuals among three major systems: market production, household, and the environment. Because these systems are closely interconnected, actions taken to reduce releases of harmful residuals (e.g., chemicals or noise pollution) to the environment will potentially reverberate throughout all of these systems.

Nevertheless, the impacts of these actions, both the benefits and costs, will ultimately be experienced as changes in well-being for households/individuals. As a result, identifying and measuring benefits and costs must focus on these changes in well-being.

Figure 4-1. Interrelationship Among Market, Environmental, and Household Systems and Social Welfare



The conceptual framework depicted in Figure 4-1 therefore provides a basis for assessing the benefits and costs of PWC restrictions in national parks. In these cases, the most direct impact will be on households that use PWC, whose recreational opportunities will be partially constrained by the restrictions. This will result in direct welfare losses to these households. In addition, the resulting changes in the behavior of these households are likely to affect environmental systems and market systems. Effects on these systems will indirectly affect the welfare of other households. For example, the park environment will be improved, and this change will enhance the “services” (primarily recreation-related) that the park provides to other households and individuals in society. On the other hand, the resulting reduction in the market demand for PWC-related goods and services will have negative impacts for those who own or work for establishments supplying these services. These types of direct and indirect impacts are identified and evaluated as part of this benefit-cost analysis.

Estimating the value of benefits and costs also requires methods for expressing welfare changes in monetary terms. In certain instances,

welfare changes are directly the result of monetary gains or losses and can therefore be thought of as being equivalent to these gains or losses. For example, welfare losses to PWC sales shops due to reductions in demand for their services can be reasonably measured as their resulting net loss in income. In other instances, welfare changes are not directly associated with pecuniary gains or losses. Such “nonmarket” changes might, for example, include the welfare gains from improved recreational opportunities in a park. In these cases a surrogate measure of gains or losses must be used; willingness to pay (WTP) is such a surrogate. Economists and other practitioners of benefit-cost analysis generally accept WTP as the conceptually correct measure for valuing changes in individuals’ welfare. WTP represents the maximum amount of money that an individual would be willing to forgo to acquire a specified change. As such it is the monetary equivalent of the welfare gain from the change.

Using this conceptual framework for identifying, measuring, and valuing changes in societal welfare, the remainder of this section and Appendix A provide a more detailed discussion of

- the types of benefits and costs associated with PWC restrictions in national parks and
- the approaches used in measuring these benefits and costs.

4.1.1 Social Benefits of PWC Restrictions

Use of PWC in national parks may be associated with a number of negative impacts on environmental resources and ecosystems. The extent to which adverse impacts will be realized is a function of several factors, including the level of use, the technology of the machines being used, and the extent to which users remain in designated areas. One result of any negative impacts that occur is that they impose welfare losses on individuals who value the parks’ environmental systems. The benefits of PWC restrictions can therefore be thought of and measured as the reduction in these losses to society. In addition, use of PWC can negatively affect society in ways that are not directly related to the environment; therefore, the benefits of PWC restrictions must also include reductions in these nonenvironmental losses.

Table 4-1 provides a broad classification of the types of environmental and nonenvironmental impacts associated with

Table 4-1. Classification of Potential Negative Impacts from PWC Use in National Parks

Impact Categories	Examples of Impacts
Environmental impacts	
Aesthetic	Noise, visibility, odor
Human health	Through impacts to air and water quality
Ecosystems	Loss of or damage to habitat and wildlife
Nonenvironmental impacts	
Infrastructure	Costs of monitoring, maintenance, and law enforcement
Human safety	Accidents
Cultural, historical, and archeological	Physical damages

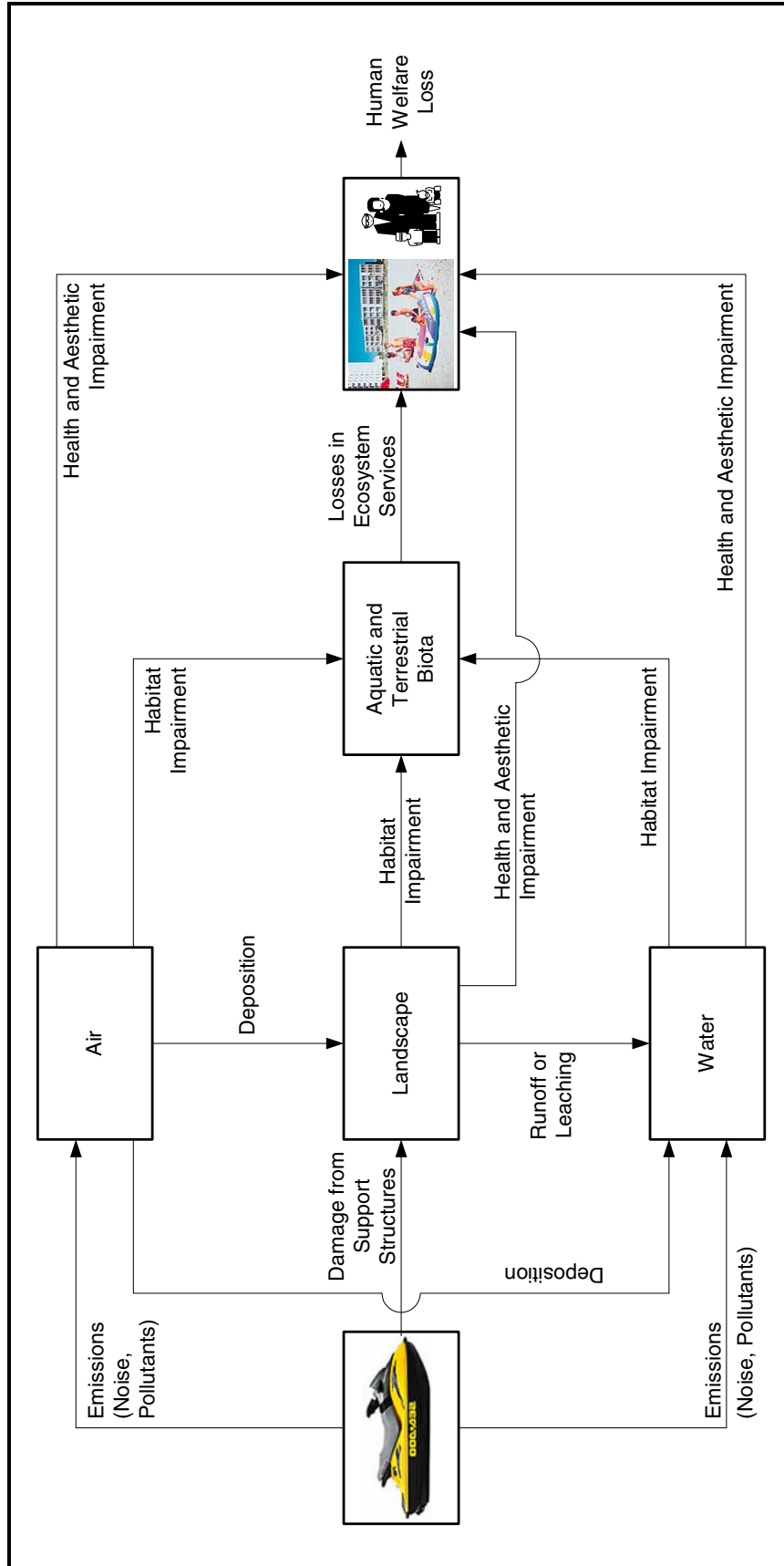
PWC use in national parks. In this section, this classification is used to more completely identify, categorize, and describe the full range of potential benefits associated with PWC restrictions in national parks in general. In Section 4.2.3, this framework is then used to specifically describe the benefits that are expected to result from the proposed restrictions.

Environmental Benefits

The use of PWC may have adverse impacts on air quality, natural resources (e.g., water quality, habitat), wildlife, and natural quiet. Figure 4-2 depicts the various categories of potential adverse effects to the environment through which PWC use in national parks can impose welfare losses on society.

- Typical PWC release substantial amounts of noise and pollutants into the environment. Noise from PWC impairs the natural soundscape for park visitors and it has the potential to negatively affect wildlife in the park. Emissions from PWC can also negatively affect park ecosystems, human health, and visitor experiences. The three primary reasons for these potential impacts are
 - ✓ up to one-third of the fuel delivered to the engine is expelled without being burned,
 - ✓ lubricating oil is mixed with fuel and thus is expelled as part of the exhaust, and
 - ✓ the combustion process results in high emissions of air and water pollutants.

Figure 4-2. Routes of Environmental Damages and Human Welfare Losses from PWC Use in National Parks



Pollutants are directly released to air and water, causing contamination of air and water resources.

As shown in Figure 4-2, all of these impacts can, directly or indirectly, lead to losses in human welfare. Therefore, from a benefit-cost perspective, those who ultimately benefit from actions to reduce these impacts will be individuals who value the quality of the park environment. Many of these beneficiaries will be park visitors whose recreational experiences are enhanced. As a point of reference, Table 4-2 reports average consumer surplus values that have been estimated for common non-PWC-related summer recreation activities from a study by Rosenberger and Loomis (2000). These are the types of recreation values that will be restored or even increased as a result of PWC restrictions.

Table 4-2. Summary of Average Recreation Values (2001\$ per person per day) for Selected Activities by Region^{a,b}

Activity	Study Location					U.S. Average
	Northeast	Southeast	Mountain	Pacific	National ^c	
Picnicking	59.64 (1)	40.22 (1)	24.79 (4)	57.80 (3)	16.95 (1)	39.87 (10)
Swimming	24.61 (5)	18.09 (1)	26.59 (1)	31.04 (3)	22.32 (1)	24.54 (11)
Hiking/backpacking	57.80 (3)	10.23 (2)	34.40 (5)	34.96 (8)	22.54 (1)	28.99 (20)
Fishing	25.20 (40)	29.96 (13)	35.05 (36)	39.93 (15)	40.24 (4)	35.46 (109)
Motor boating	43.78 (3)	16.24 (1)	54.52 (8)	NA	41.80 (1)	34.54 (14)

NA = Not available.

^aAll amounts were inflated using the consumer price index for recreation available from the Bureau of Labor Statistics (Series ID: cuur0000sar). Numbers in parentheses represent the number of observations (i.e., studies).

^bThese values were taken from studies conducted between 1967 and 1998.

^cStudies estimating nationwide values.

Source: Rosenberger, Randall, and John Loomis. 2000. "Using Meta-Analysis for Benefit Transfer: In-Sample Convergent Validity Tests of an Outdoor Recreation Database." *Water Resources Research* 36(4):1097-1107.

Even individuals who are not park visitors (i.e., nonusers) can benefit from the knowledge that park resources are being protected and preserved. In other words, they may hold positive "nonuse values" (i.e., a positive WTP) for protecting the park environment. These nonuse values can stem from the desire to ensure others' enjoyment (both current and future generations) or from a sense that these resources have some intrinsic value. Evidence of such

nonuse values for park protection is provided in studies that have documented significant WTP by nonusers for improved air quality at parks (e.g., Chestnut and Rowe, 1990) and, more generally, for the protection of unique species and ecosystems (see, for example, Pearce and Moran [1994] for a review of such studies). Restrictions on PWC use in national parks can therefore provide benefits to both users and nonusers in a number of ways by protecting the parks' ecological resources.

Appendix A provides a more detailed discussion of the nonenvironmental benefits, in particular, how these restrictions can improve public safety in national parks and reduce the costs of operating and maintaining the infrastructure necessary to support and monitor PWC use.

4.1.2 Social Costs of PWC Restrictions

The primary losses associated with PWC restrictions in national parks will accrue to

- PWC users, in particular individuals who will not use PWC in the park as a direct result of the restrictions, and
- providers of PWC-related services for park visitors.

The welfare losses to individual consumers (PWC users) are measured by their loss in consumer surplus, while losses to producers are measured by their loss of producer surplus.

Appendix A provides more detail on measuring losses to consumers and producers.

4.1.3 Identifying Relevant Benefits and Costs

To conduct the benefit-cost analysis, the relevant benefits and costs must be identified. In this section, NPS discusses two economic concepts that are important for an analysis of the benefits and costs of the proposed PWC regulations: indirectly affected secondary markets and distorted primary markets. Often consumers and producers may be indirectly affected by a policy. For example, regulating PWC use in national parks may lead to decreased demand for PWC sales or rentals and increased demand for motorboats or canoes. Whether these indirect, or secondary, impacts should be included in the analysis depends on whether the change in demand or supply in the secondary market results in prices changes (for details, see a benefit-cost analysis textbook such

as Boardman et al. [1996]). In general when the policy change in the primary market causes prices to change in the secondary markets, the net change in social welfare from the secondary market should be included in the benefit-cost analysis. If prices do not change in the secondary market, the revenue gains or losses should not be included in the benefit-cost analysis. Without more detailed information, NPS is unable to predict whether the proposed alternatives will change prices for PWC sales or rentals. Thus, losses or gains to businesses that may be indirectly affected by the proposed rule are included in the benefit-cost analysis.

Distorted primary markets will also be important in analyzing the impact of the proposed PWC regulations. As described above, PWC use may generate negative externalities, such as air pollution and noise that affect other park visitors and park resources. If PWC do generate negative externalities, then the private cost of using a PWC (the cost to the individual PWC user) will be lower than the social cost of PWC use (where the social cost of PWC use includes both the cost to the PWC user plus the costs to others that result from the negative externalities associated with PWC use). Because PWC users do not have to pay the full social cost of using a PWC and instead only pay the lower, private cost, PWC use will be too high. In addition, measures of net consumer surplus to PWC riders that do not account for the additional costs imposed on society by the negative externalities associated with PWC use will overstate the true net social welfare associated with the activity.

4.2 RESULTS FOR FIRE ISLAND NATIONAL SEASHORE

Based on the approach and possible impacts outlined above, this section presents the results of the benefit-cost analysis for FIIS. The section discusses the groups most directly affected by the proposed change in regulation and several scenarios for the possible levels of impacts. The benefits and costs accruing to these groups are then presented.

4.2.1 Affected Groups

For the purpose of this study, six major affected groups, listed in Table 4-3, have been identified:

Table 4-3. Impact of Alternatives on User Groups

User Group	Alternative A	Alternative B	Alternative C	No-Action Alternative
1. PWC Users	<ul style="list-style-type: none"> No change in consumer surplus. 	<ul style="list-style-type: none"> Consumer surplus is expected to decrease as a result of spatial restrictions on PWC use. 	<ul style="list-style-type: none"> Consumer surplus is expected to decrease somewhat more than for Alternative B due to additional spatial restrictions and institution of no-wake zones. 	<ul style="list-style-type: none"> Consumer surplus is expected to decrease more than under alternative C as a result of the ban of PWC in FIIS.
2. Other Visitors or Potential Visitors: Canoe Users, Anglers, Other Boaters, Swimmers, Hikers and Other Visitors	<ul style="list-style-type: none"> No change in consumer surplus. 	<ul style="list-style-type: none"> Consumer surplus is expected to increase slightly for current users of FIIS as a result of increased solitude, increased water quality, and a decrease in the risk of accidents involving PWC. Consumer surplus is expected to increase for new visitors who would not have visited FIIS without these restrictions on PWC use. 	<ul style="list-style-type: none"> Consumer surplus is expected to increase for current users of FIIS in a manner similar to Alternative B, although the magnitude of the increase may be somewhat greater due to the institution of further spatial restrictions and of no-wake zones that will slow PWC. Consumer surplus is expected to increase slightly more than under Alternative B for new visitors who would not have visited FIIS without these restrictions on PWC use. 	<ul style="list-style-type: none"> Consumer surplus is expected to increase for current users of FIIS in a manner similar to Alternative C, although the magnitude of the increase may be somewhat greater because PWC will no longer be allowed in FIIS. Consumer surplus is expected to increase somewhat more than under Alternative C for new visitors who would not have visited FIIS without these restrictions on PWC use.

(continued)

Table 4-3. Impact of Alternatives on User Groups (continued)

User Group	Alternative A	Alternative B	Alternative C	No-Action Alternative
3. Producers of PWC services: PWC rental shops PWC sales shops Other parts of the local economy providing services to PWC users	<ul style="list-style-type: none"> No change in producer surplus. 	<ul style="list-style-type: none"> PWC rental shops are not expected to experience a measurable decline in producer surplus. PWC sales shops are expected to experience a decline in producer surplus due to a fall in the demand for PWC. Other parts of the local economy such as hotels, restaurants, and gas stations located on Fire Island may have a small decrease in producer surplus. There is not expected to be a measurable impact on the regional economy. 	<ul style="list-style-type: none"> PWC rental shops are not expected to experience a measurable decline in producer surplus. PWC dealerships are expected to experience a decline in producer surplus somewhat greater than under Alternative B. Other parts of the local economy such as hotels, restaurants, and gas stations located on Fire Island may have a small decrease in producer surplus. There is not expected to be a measurable impact on the regional economy. 	<ul style="list-style-type: none"> PWC rental shops are not expected to experience a measurable decline in producer surplus. Producer surplus for PWC dealerships may decrease significantly more than under Alternative C as a result of a decline in sales and servicing of PWC. Other parts of the local economy such as hotels, restaurants, and gas stations located on Fire Island may have a decrease in producer surplus. There is not expected to be a measurable impact on the regional economy.
4. Local Residents of the area surrounding FIIS	<ul style="list-style-type: none"> No change in welfare. 	<ul style="list-style-type: none"> Local residents who use PWC may experience a decline in welfare if they live in areas adjacent to zones restricted from PWC use. Local residents who do not use PWC may experience an increase in welfare as a result of a decline in noise, increased water quality, and a decrease in the risk of accidents involving PWC. 	<ul style="list-style-type: none"> Local residents who use PWC may experience a decline in welfare somewhat greater than under Alternative B because access for PWC is limited to the ferry channels. Local residents who do not use PWC may experience an increase in welfare as a result of a decline in noise, increased water quality, and a decrease in the risk of accidents involving PWC. 	<ul style="list-style-type: none"> Local residents who use PWC will experience a decline in welfare greater than under Alternative C due to a ban of PWC on FIIS. Local residents who do not use PWC may experience an increase in welfare as a result of a decline in noise, increased water quality, and a decrease in the risk of accidents involving PWC.

(continued)

Table 4-3. Impact of Alternatives on User Groups (continued)

User Group	Alternative A	Alternative B	Alternative C	No-Action Alternative
5. Producers of services for visitors to FIMS who do not use PWC	<ul style="list-style-type: none"> No change in producer surplus. 	<ul style="list-style-type: none"> Producer surplus is expected to increase because restrictions on PWC may result in an increase in demand for angling, canoeing, and other activities in FIMS, resulting in an increased demand for the provision of services related to these activities. 	<ul style="list-style-type: none"> Producer surplus is expected to increase because restrictions on PWC may result in an increase in demand for angling, canoeing, and other activities in FIMS, resulting in an increased demand for the provision of these activities. This increase is not expected to be significantly larger than under Alternative B. 	<ul style="list-style-type: none"> Producer surplus is expected to increase because restrictions on PWC may result in an increase in demand for angling, canoeing, and other activities in the preserve, resulting in an increased demand for the provision of services related to these activities. This increase may be somewhat larger than under Alternatives B and C.
6. The general public who may care about FIMS even if they do not visit	<ul style="list-style-type: none"> No change in welfare. 	<ul style="list-style-type: none"> May experience an increase in welfare as a result of enhanced nonuse values resulting from increased environmental quality. 	<ul style="list-style-type: none"> May experience an increase in welfare as a result of enhanced nonuse values resulting from increased environmental quality. This increase is not expected to be significantly larger than under Alternative B. 	<ul style="list-style-type: none"> May experience an increase in welfare as a result of enhanced nonuse values resulting from increased environmental quality in the preserve. The increase in welfare is expected to be larger than under Alternatives B and C because of the complete exclusion of PWC from FIMS.

1. PWC users, in particular those who currently use PWC in FIIS
2. Other visitors or potential visitors who may have a different experience at the park if PWC are banned or restricted in FIIS (canoeists, anglers, swimmers, hikers, boaters, and other visitors)
3. Producers of PWC services in the area surrounding FIIS who may experience a change in their welfare (e.g., PWC rental shops, PWC sales, restaurants, gas, hotels)
4. Local residents of the area surrounding FIIS
5. Producers of services to other types of summer visitors (e.g., canoe rentals or powerboat rentals) who may experience a change in their welfare
6. The general public who may care about FIIS even if they do not visit the park

The impacts on these groups under each alternative are discussed in more detail below.

Under Alternative A, NPS expects no change in welfare for any users relative to current conditions because PWC would still be allowed in FIIS.

Alternative B positively affects all users except PWC users and PWC dealerships, because PWC would be restricted in a large portion of the shoreline waters of FIIS. The impact on boaters is somewhat ambiguous because of the potential for accidents between boaters and PWC users. Reducing the number of PWC in the park and the speed at which they travel should have positive impacts on other boaters' consumer surplus. However, although the risk of accidents in NPS waters is decreased, it is possible that congestion will increase in the waters surrounding the communities on Fire Island and in non-NPS waters. Consequently, the risk of accidents might actually increase overall. The adverse effects of PWC use on swimmers, as well as canoeists and potentially other boaters, are reduced under Alternative B because of spatial limitations on PWC use.

Alternative C positively affects all users except PWC users and PWC dealerships, because PWC would not be allowed in shoreline waters except in ferry channels. As outlined above, the impact on boaters is likely to be positive but is ambiguous because of the potential for congestion outside of park waters. The implementation of a 1,000-foot buffer around the communities will limit PWC access to the island to the ferry channels. This will have

an adverse effect on all PWC users, including owners of large boats who use PWC to travel to and from their boats. The adverse effects to swimmers, as well as canoeists and potentially other boaters, are reduced under Alternative C relative to Alternative B because further spatial limitations and no-wake restrictions would be enforced.

The no-action alternative also has positive welfare effects for all users except PWC users and PWC dealerships, although the magnitude of the welfare change is larger for this alternative than for Alternatives B and C. Similar to the case for Alternatives B and C, the impact on boaters is most likely positive but is somewhat ambiguous because of the potential for increased congestion in waters outside of FIIS. Adverse impacts of PWC on swimmers, canoeists, and other users within FIIS are greatly reduced under the no-action alternative because PWC are no longer allowed within the park's boundaries. PWC outside the park boundaries may still have some negative impacts on users within FIIS, however.

4.2.2 Scenarios

To develop estimates of the benefits and costs of the proposed rule under each alternative, NPS used the scenarios described below. NPS considers current conditions to be the baseline to which the alternatives are compared. The only rental shop identified in the area of FIIS is not expected to realize impacts under any of the proposed alternatives.

Alternative A: The first alternative assumes continued PWC use as currently managed under a special regulation. Under this scenario, NPS assumes no reduction in PWC sales.

Alternative B: The second alternative allows continued PWC use with additional geographic restrictions. For this alternative, NPS assumes that there will be a 0 to 20 percent reduction in revenues related to PWC sales based on interviews with local PWC dealerships.

Alternative C: The third alternative also allows continued PWC use with additional restrictions on area of use in Alternative B, and it also implements a no-wake zone. Under this alternative, NPS assumes that there will be a 0 to 25 percent reduction in PWC sales based on interviews with local PWC dealerships.

No-Action Alternative: This alternative bans the use of PWC in FIIS effective April 2002. Under this scenario, NPS assumes a 50 to 70 percent reduction in PWC sales based on interviews with local PWC dealerships.

4.2.3 Benefits

As described in Section 4.1 and Appendix A, PWC use in national parks can be linked to a wide variety of negative impacts. Restricting the use of PWC in these parks can therefore benefit society in a number of ways. One potentially important source of benefits to society is the improvement in the condition of natural resources that may result from PWC restrictions. Section 2.5 describes the impacts on natural resources that are most likely to result from PWC use within the boundaries of FIIS. This section describes how these impacts will be reduced by the regulatory alternatives identified above and assesses the benefits of these regulations. Assessing these benefits in strictly quantitative (i.e., monetary) terms is unfortunately not feasible with currently available data; therefore, the benefits are largely described in qualitative terms. Quantitative estimates for the value of a beach day do exist. Bell and Leeworthy (1990) use the travel cost method to estimate the value of a beach day. They estimate that a beach day at an ocean beach in Florida is worth \$34 per person. Deacon and Kolstad (2000) review the literature and arrive at a range in estimates of \$1 to \$6 a day for beach use at a variety of beaches. They state that this variance in estimates is due to the differences in quality between beaches. For instance, Freeman (1995) reports estimates of the value of a beach day as high as \$50 for a day at a beach with a reef resource. He also argues that the value of a beach day depends on site quality.

The primary beneficiaries of Alternatives B, C, and the no-action alternative would be FIIS visitors who do not use PWC and whose park experience is negatively affected by the presence of PWC. In FIIS, other popular activities include canoeing, fishing, boating, and hiking. There is no entrance fee at FIIS; therefore, visitation is estimated by FIIS by the number of people using the visitor's centers on the island. FIIS reports an average of 600,000 visitors a year. However, when taking into account all visitors within the boundaries of the park, the estimate could be as high as 3 to 4

million (NPS, 2002). The lack of accurate visitation data prohibits an estimate of consumer surplus gains for non-PWC users as a result of PWC restrictions.

“Nonusers” of the park are also likely to benefit from the proposed measures (see Section 4.1 and Appendix A for more details). For example, individuals who do not visit the parks can benefit simply from the knowledge that the natural resources of the park are being protected. Part of this benefit may stem from an increased assurance that the quality of the parks’ resources is being protected for the enjoyment of future generations. Therefore, some of the benefit categories described below, in particular those associated with the preservation of unique park resources and ecosystems, may accrue in the form of nonuse values.¹

Aesthetic Benefits

Alternatives that impose restrictions on PWC use will reduce noise levels in the areas where PWC are currently allowed. Restrictions will improve the level of natural quiet along portions of the shoreline. Restrictions on PWC also have the potential to improve visibility by limiting the amount of ozone emitted. However, the large number of motorized boats already operating along the shore will reduce any aesthetic impacts of banning PWC in these areas.

Alternative A, which continues current policy, offers no benefits from aesthetic improvements to non-PWC park visitors over current conditions.

Alternative B will ban the use of PWC in all parts of FIIS except for some of the communities on the bay side of the island. These areas may experience a small reduction in noise, but noise from other boating activities would still infiltrate the bay and remaining park areas. Visibility impacts would be negligible.

¹The importance of recognizing these values is affirmed in the Organic Act. It established the fundamental purpose of the national park system, which includes providing for the enjoyment of park resources and values by the people of the United States. The mandate applies not just to the people who visit parks—but to all people—including those who derive inspiration and knowledge from afar. Furthermore, through the Redwood Act of March 27, 1978, Congress has provided that when there is a conflict between conserving national park resources and values and providing for enjoyment of them, conservation is to be the primary concern.

Alternative C is unlikely to have substantial aesthetic benefits beyond those described for Alternative B because of the prevalence of other motorized boats along the shore.

The **no-action alternative** will have the greatest impact because it will ban PWC from all areas in FIIS. However, as described under Alternative B, noise from other boating activities would still infiltrate the bay and remaining park areas.

The PWC location restrictions under Alternative B, Alternative C, and the no-action alternative will provide additional recreation benefits to recreators in the parks, such as canoeists, anglers, birdwatchers, and hikers. Noise emissions have been identified as a particular nuisance to nonmotorized recreators, such as canoeists and hikers, who tend to place a particularly high value on the tranquility and natural soundscape offered by the parks. Anglers using motorized boats also value the natural soundscape. Therefore, reducing noise from PWC activity in the parks will benefit both motorized and nonmotorized recreators.

In addition to generating high noise levels, PWC also emit strong-smelling fumes that can be bothersome to other recreators and reduce visibility. These effects tend to be much more localized than noise emissions. NPS has determined that visibility impacts from emission reductions due to restrictions on PWC under these alternatives will be negligible.

Human Health Benefits

PWC emissions contain relatively high levels of pollutants such as VOC, CO, PM, nitrogen oxides (NO_x), and hydrocarbons (HCs), which are potentially damaging to human health. It is very unlikely that the level of PWC use in FIIS represents a significant health threat to humans; nevertheless, the potential for adverse health effects exists. For example, some of the toxic hydrocarbons are potentially harmful even at very low levels of exposure (EPA, 2000a; EPA, 1999a). The large number of other motorized watercraft that operate inside FIIS will limit the impact on human health of banning PWC. In summary, the health benefits from the proposed regulation are expected to be minor for all of the alternatives.

Ecosystem Protection Benefits

As discussed in Section 4.1 of this report PWC use has the potential to negatively affect ecosystems and natural habitats in a variety of ways. In the case of national parks, these natural resources are of particular value to the public. Although current levels of PWC use in FIIS are not expected to cause widespread ecosystem damages, restricting PWC in the parks can nonetheless provide benefits to visitors and nonusers by protecting some of the parks' natural resources.

Alternative A: This alternative offers no benefits to society for ecosystem protection compared to the current situation.

Alternative B: This alternative would have some beneficial impact on water quality. However, as discussed in Section 2, the restrictions on PWC proposed under Alternative B are not likely to result in major benefits through the protection of FIIS' ecosystems because of the prevalence of motorized watercraft other than PWC in FIIS.

Alternative C: This alternative would have a slightly greater beneficial impact on water quality than Alternative B. The additional spatial restrictions would help reduce turbidity levels and near-shore loadings of contaminants and minimize physical damage. However, the cumulative effect would still be small because of the presence of other motorized watercraft.

No-Action Alternative: This alternative would have a greater beneficial impact on water quality and natural resources than B and C, but because PWC use would still be allowed adjacent to national seashore boundaries, the impacts of this alternative would be minimal.

As discussed in Section 2.5, the presence of PWC in the park may adversely affect fish and wildlife. In addition to being a potential nuisance to other recreators, noise from PWC may disturb wildlife. Localized, short-term effects on wildlife would be reduced under Alternative B, Alternative C, and the no-action alternative by reducing noise disturbance and the chance for collisions with wildlife. There would also be a long-term beneficial impact to aquatic biota and the ecosystems in the park because of

improvements in water quality and a reduction in physical disturbances.

Reducing potential harm to the park's ecosystems will benefit park visitors, for example, by improving their chances of viewing wildlife in a less stressful environment. It will also provide benefits to individuals across the country who value the park's unique ecosystems and natural habitats, regardless of whether they actually visit the park. That is, protecting the park's ecosystems can provide extensive nonuse benefits to society.

Safety and Congestion Benefits

In addition to environmental benefits associated with reductions in PWC use, there also may be safety and congestion benefits. Since 1990, injuries associated with the recreational use of PWC have increased at least four-fold. The number of injuries reported from PWC use is now higher than that reported from motorboat use in the U.S. (Branche, Conn, and Annett, 1997). Because of the disproportionately large number of injuries associated with PWC use, reducing their use may improve the safety of park visitors. In addition, the level of congestion is an important factor determining visitor enjoyment. Reductions in congestion related to PWC use may therefore have benefits to other park users.

Alternative A: This alternative offers no other benefits to society related to safety and congestion compared to the current situation.

Alternative B: Potential benefits from Alternative B include those associated with reductions in the risks of PWC-related safety hazards. If Alternative B reduces the number of PWC in the park, it may benefit all recreators by reducing their risks of being involved in accidents with PWC. Alternative B might also result in an increase in PWC use in areas where PWC would still be allowed (i.e., in areas surrounding the communities on FIPS), increasing congestion and the chance for safety risks in these areas.

Alternative C: Other potential benefits from Alternative C include those discussed for Alternative B as well as the added benefits resulting from the additional spatial restrictions and the no-wake restriction. The no-wake restriction would require PWC users to reduce their speed in the ferry channels; thus, the potential for accidents may decrease.

No-Action Alternative: Similar to Alternatives B and C, this alternative has the potential to reduce PWC-related accidents in NPS waters. However, because congestion might increase in non-NPS waters, overall potential accidents could increase.

Reducing PWC-related accidents will also reduce the costs to NPS associated with medical/rescue operations, which will allow these resources to be redirected to other park management activities. However, officials at FIIS have indicated that medical/rescue operations associated with PWC are relatively uncommon. Therefore, these benefits are likely to be minor in FIIS.

4.2.4 Costs

PWC users, as well as some businesses in the local area, may experience welfare losses as a result of the proposed alternative regulations.

Costs to PWC Users

Two groups of PWC riders may be affected by the proposed regulations: riders who currently ride in FIIS and riders who use PWC in other areas outside FIIS where riders displaced from FIIS may decide to ride if PWC use in FIIS is restricted.

For PWC users who currently ride in FIIS or who want to ride in the park in the future, prohibitions or restrictions on areas where PWC are allowed in the park could result in consumer surplus losses. To the extent that individuals consider other PWC areas, such as those in the nearby area, close substitutes, the loss in consumer surplus associated with restricting PWC use in the park will be lower.

If each individual's demand curve for riding a PWC in FIIS were known, then we could add up the loss of consumer surplus for each individual to find the total loss in consumer surplus to PWC riders from the proposed regulations. Because the demand curve reflects the individual's preferences for available substitute activities and the cost of these activities, measuring the lost consumer surplus from a trip in the park takes into account substitute activities.

In this case, we do not know the consumer surplus associated with PWC use in FIIS nor do we know the riders' next best alternative activities. After conducting an extensive review of the economics literature and consulting with the authors of existing studies, experts

in recreation demand analysis at universities, and experts at other consulting firms, NPS was unable to locate a study that estimated the consumer surplus for a PWC trip. A review of the recreation literature conducted by Rosenberger and Loomis (2000) found an average value of \$31.98 (1996 dollars) per person per day for riding in motor boats (with estimates ranging from \$15 to over \$50). The same study reports a value of \$21.78 (1996 dollars) per person per day (with estimates ranging from \$11 to over \$30) for off-road driving. These estimates, along with the estimates in Table 4-2, provide a range of values for activities similar to riding PWCs and provide a bound on the consumer surplus loss expected from the proposed regulations.

PWC users who currently ride in nearby areas where displaced riders from FIIS may visit will lose some consumer surplus if these areas become more crowded because of restrictions on PWC use in FIIS. Although no studies were available that examined the impact of congestion on the value of a PWC trip, other recreation demand studies find that congestion lowers the value of a recreation experience (see Appendix A).

Below we discuss the estimated impact of each proposed alternative on PWC users.

Alternative A: Under Alternative A, NPS anticipates no change in PWC use as a result of the regulation. Consumer surplus to PWC riders will remain unchanged from current conditions.

Alternative B: Restricting PWC from park waters except for those areas surrounding the communities on FIIS may decrease the consumer surplus of PWC users. However, because community waters will still be open to PWC and substitute areas for recreational PWC use are near FIIS, NPS expects minimal consumer surplus losses if Alternative B is implemented.

Alternative C: This alternative would impose the same restrictions as Alternative B, with the addition of a 1,000-foot buffer around the island for all waters except for the ferry channels, where a no-wake restriction would be implemented. This may reduce the accessibility of the park, particularly for PWC owners that live in areas closed to PWC use. Because substitute areas exist nearby, there will likely be some shifting of recreational use away from FIIS and towards these areas. However, those people relying on PWC

as a form of transportation around Fire Island, between islands, and to reach their larger boats may have to find alternative forms of transportation, especially if they own or rent a home in an area closed to PWC use.

Overall, NPS expects this alternative to result in minor to moderate losses in consumer surplus.

No-Action Alternative: The no-action alternative would result in a total ban on PWC use in FIIS. The riders of the PWC used in FIIS each year would lose the full value of their consumer surplus for rides in FIIS.

Costs to the Local Area Businesses

If PWC riding decreases as a result of the regulation, then the suppliers of PWC sales and rental services may be affected. In addition, lodging establishments, restaurants, gas stations, and other businesses that serve PWC riders could experience a reduction in business from the proposed regulation. The following section describes the approach used to develop quantitative estimates of these impacts and reports the results of the cost analysis for local area businesses.

PWC Sales and Rental Services. NPS identified one firm that rents PWC in the FIIS region and 14 sales shops. It is unlikely that the rental shop will be affected by the proposed restrictions because it operates north of FIIS in Hampton Bay area. However, based on interview data, there are sales shops expected to be affected under Alternatives B, C, and the no-action alternative.

To provide a quantitative estimate of lost producer surplus resulting from the proposed regulations, NPS computed total revenue for each shop in one of the following ways:

- Interview Data—NPS multiplied the number of PWC units sold by the average price (\$7,800) of PWC (PWIA, 2002) to obtain PWC revenue. Next, we divided this estimate by the proportion of sales accounted for by PWC sales to obtain total firm revenue.
- InfoUSA Data—NPS used the midpoint of the sales range reported for the firm.
- Census Data—When interview or InfoUSA data were unavailable, we used the average establishment revenue for NAICS 532292 or 441221 using state-level data reported by

the U.S. Bureau of Census (2002). These values are \$0.309 and \$2.027 million, respectively.

Based on this approach, we estimated the one rental shop had annual sales of \$0.309 million and the 14 sales shops had annual revenues of \$40 million.

To translate lost revenue into lost producer surplus, we used estimates of the decline in revenue associated with the rule and return-on-sales measure for the SIC code provided by Dun & Bradstreet (D&B). The use of this profit margin only approximates losses in producer surplus. Producer surplus captures the difference between variable costs and revenue, while return on sales contains other measures reflecting fixed costs, taxes, and/or accounting conventions rather than measures of variable profits. For this reason, the use of D&B accounting profit margin data may understate producer surplus losses.

The profit ratios, net profit after tax divided by sales, come from D&B for SIC 5571 and SIC 7999 (Dun & Bradstreet, 2001).² The upper quartile profit ratio for sales shops is 4.6 percent and the lowest quartile is 0.6 percent. The upper quartile profit ratio for rental shops is 8.7 percent and the lowest quartile is -3.4 percent. However, none of the rental shops that NPS interviewed indicated that they had a negative profit margin. Therefore, we used the median profit ratio (3.9 percent) in this analysis.

As noted above, NPS believes the single rental shop will not be significantly affected by the proposed restrictions because it operates north of FIIS in Hampton Bay area.

PWC sales shop losses are expected to occur under Alternative B, C, and the no-action alternative. Under Alternative B, NPS estimates of the producer surplus loss to the PWC sales shop range from \$0 to \$132,090 (see Table 4-4). Similar impacts occur under Alternative C, with producer surplus losses ranging from \$0 to

²Dun & Bradstreet data for NAICS codes are not currently available. Therefore, NPS used the comparable SIC code (5571, Motorcycle Dealers) as defined by the U.S. Census. For rental shops, NPS used SIC code 7999 (Amusement and recreation NEC).

Table 4-4. Range of Estimates for Lost Producer Surplus, PWC Sales Shops (2001\$)

	Estimated Loss in Revenue to PWC Sales Shops	Estimated Loss in Producer Surplus for High and Low Profit Ratios
Alternative A	\$0	\$0
Alternative B		
Scenario 1	\$0	\$0
Scenario 2	\$2,871,480	\$17,230 to \$132,090
Alternative C		
Scenario 1	\$0	\$0
Scenario 2	\$3,589,350	\$21,536 to \$165,110
No-Action Alternative		
Scenario 1	\$7,178,710	\$43,070 to \$330,221
Scenario 2	\$10,05,190	\$60,301 to \$462,310

Note: Dollar values rounded to the nearest \$10.

\$165,110.³ Under the no-action alternative, producer surplus loss estimates increase, ranging from \$43,070 to \$462,310.

Lodging Establishments, Restaurants, Gas Stations, and Other Businesses. PWC users and PWC sales comprise a minute fraction of total economic activity in the area surrounding FIIS, which includes New York City. Therefore, the total regional sales of lodging establishments, restaurants, gas stations, and other businesses that serve PWC riders are not likely to experience a measurable decline in business under any of the alternatives. However, it is possible that there will be localized impacts on tourism-related businesses located on Fire Island if PWC restrictions result in reduced visitation to the island.

³For Alternatives B and C, NPS believes that it is unlikely that all 14 sales shops would experience the upper bound impact estimate because interview responses for three sales shops suggest these alternatives would not significantly change PWC sales.

5

Small Entity Impact Analysis

The proposed regulation potentially affects the economic welfare of a number of businesses, large and small. However, small entities may have special problems in complying with such regulations. The RFA of 1980, as amended in 1996, requires special consideration be given to these entities during the regulatory process.

To fulfill these requirements, agencies must perform a review to determine whether a proposed or final rule will have a significant economic impact on a substantial number of small entities (SISNOSE). NPS conducted a screening-level analysis to determine whether this rule is likely to impose such an impact using criteria developed by other agencies (National Marine Fisheries Service [NMFS], 2000; EPA, 1999b; U.S. Small Business Administration [SBA], 1998).

5.1 IDENTIFYING SMALL ENTITIES

Small entities potentially affected by the rule include companies providing PWC rentals, sales, and service; lodging establishments; restaurants; grocery stores; and other retail businesses. The minimal expected changes in total visitation to the Long Island area as a result of implementing any of the proposed alternatives suggest that there will be no noticeable regional impacts on lodging establishments, restaurants, grocery stores, or other retail businesses. It is possible that these industries in communities located on Fire Island may experience localized impacts. However, all of the Fire Island property rental agencies interviewed by NPS indicated that

they believed a ban on PWC would have no impact on visitation to the island. Thus, the businesses most likely to be directly affected by PWC regulations are those offering PWC rental, sales, and/or services. NPS identified one PWC rental shop and 14 PWC sales shops located in communities near FIIS.

The SBA's general size standard definitions for these industries (NAICS 532292—Recreational Goods Rental¹ and NAICS 441221—Motorcycle Dealers²) classifies companies with annual sales less than or equal to \$5 million as small. NPS computed total revenue for each shop in one of the following ways:

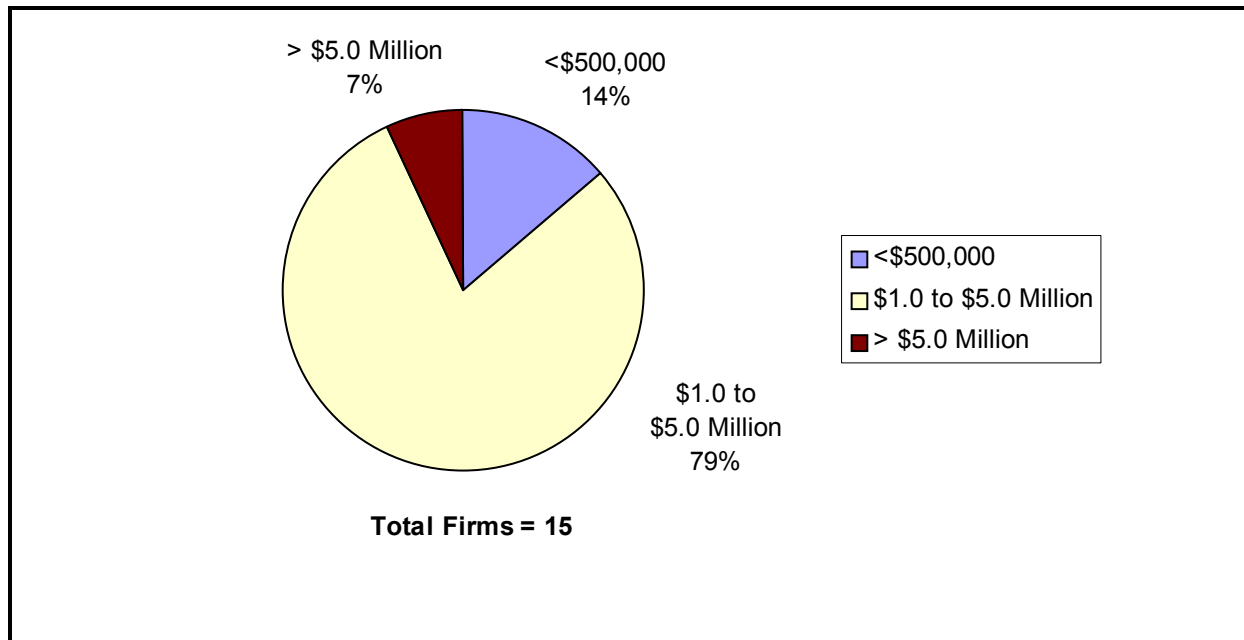
- Interview Data—NPS multiplied the number of PWC units sold by the average price (\$7,800) of PWC (PWIA, 2002) to obtain PWC revenue. Next, we divided this estimate by the proportion of sales accounted for by PWC sales to obtain total firm revenue.
- InfoUSA Data—NPS used the midpoint of the sales range reported for the firm.
- Census Data—When interview or InfoUSA data were unavailable, we used the average establishment revenue for NAICS 532292 or 441221 using state-level data reported by the U.S. Bureau of Census (2002). These values are \$0.309 and \$2.027 million, respectively.

Based on this approach, we estimated the one rental shop had annual sales of \$0.309 million and the 14 sales shops had a total of \$40 million in annual revenue.

The distribution of total company sales for the 15 firms is shown in Figure 5-1. Two of these companies are estimated to have less than \$500,000 in annual sales (14 percent), 11 are estimated to have annual sales between \$1,000,000 and \$5,000,000 (79 percent), and one has annual sales exceeding \$5,000,000 (7 percent). Using this criterion and sales data, 14 of the 15 firms identified are classified as small businesses.

¹This industry comprises establishments primarily engaged in renting recreational goods, such as bicycles, canoes, motorcycles, skis, sailboats, beach chairs, and beach umbrellas.

²This industry comprises establishments primarily engaged in retailing new and/or used motorcycles, motor scooters, motor bikes, mopeds, off-road all-terrain vehicles, and personal watercraft, or retailing these new vehicles in combination with repair services and selling replacement parts and accessories.

Figure 5-1. Distribution of Firms by Estimated Company Sales Range

5.2 SCREENING-LEVEL ANALYSIS

As noted above, NPS identified one firm that rents PWC in the FIIS region and 4 sales shops. However, it is unlikely that the single rental shop will be affected by the proposed restrictions because it operates north of FIIS in the Hampton Bay area. NPS has made several attempts to contact this rental shop but has not yet received any supplemental information from this firm.

To assess the potential economic impact of this rule on small entities, NPS estimated the change in revenues for the 14 PWC sales shops under the four proposed alternative regulations.³ The first alternative assumes continued PWC use as currently managed. Alternative B allows continued PWC use with restrictions on area of use. Under this alternative, the areas surrounding the communities on FIIS will continue to be open to PWC use, but other areas will be closed to PWC. Based on interview data, NPS assumed sales reductions between 0 and 20 percent for this alternative. Alternative C also allows continued PWC use. This alternative

³In addition, it is possible that small businesses serving visitors to Fire Island will experience a reduction in revenue. However, the extent to which their sales would decline as a result of PWC restrictions is unknown.

includes the geographical restrictions imposed under Alternative B as well as additional limits on PWC use. Under Alternative C, access to FIIS will be limited to the ferry channels. Outside the ferry channels, PWC would no longer have access to FIIS because this alternative imposes a buffer zone of 1,000 feet around the island where PWC could not be legally operated. This alternative also requires implementing no-wake zones for PWC in the ferry channels. Under Alternative C, NPS has assumed that there will be a 0 to 25 percent reduction in PWC sales revenues based on interview data. Under the no-action alternative, a ban on PWC use in FIIS becomes effective in April 2002. Under this scenario, NPS assumed a 50 to 70 percent reduction in PWC sales based on interviews with local PWC dealerships.

5.2.1 Economic Impacts

The cost imposed by the rule is the loss of potential revenue associated with PWC sales, rentals, and service. This burden may be significant to the financial viability of companies dependent on growth in operating revenue to provide cash needed to meet long-term obligations such as equipment purchase loans.

A company's short-run financial strength is substantially influenced, among other things, by its liquidity (working capital position and its ability to pay short-term liabilities). Unfortunately, data are not available on the amount of working capital that these operators have to finance changes in short-term costs associated with lost revenue.

An alternative quantitative assessment of the rule's impact on companies examines the size of the revenue losses relative to total annual revenues from all sources. The lower the relative importance of these losses, the greater the likelihood of the company remaining viable.

NPS analysis estimated the following revenue impacts under the three alternatives:

- Alternative A—No impacts
- Alternative B—Total PWC sales revenue losses range from \$0 to \$2.8 million. This is a reduction of 0 to 7.2 percent of total company revenues.

- Alternative C—Total PWC sales revenue losses range from \$0 to \$3.6 million. This is a reduction of 0 to 9.0 percent of total company revenues.
- No-Action Alternative—Total PWC sales revenue losses range from \$7.2 to \$10.1 million. This is a reduction of 17.9 to 25.1 percent of total company revenues.

5.2.2 Closure Analysis

NPS is unable to determine with certainty the extent to which the proposed regulation will cause small entities to close their operations. Upper-bound estimates of revenue losses under Alternatives B and C and the no-action alternative suggest potentially significant impacts on company revenues. However, none of the PWC sales and rental shops interviewed indicated they would go out of business as a result of the regulation. In addition, three of the seven firms interviewed believed Alternatives B and C would not have a significant impact on sales.

5.2.3 Distributional Impacts

NPS considered how the impacts of the rule were distributed across stakeholder firms in two ways. First, we considered whether small sales firms were disproportionately affected relative to large sales firms. Interview responses suggest that the one large firm would experience similar or higher impacts than the small firms. Therefore, it appears that small operators will not be put at a competitive disadvantage relative to the large operator as a result of the rule. Second, we considered the distribution of impacts within the universe of small entities. Although the impact analysis does not require this comparison, NPS believes that some PWC sales shops may be disproportionately affected compared to their local competitors because interview data suggest differences in shares of customers using Fire Island. Firms with higher shares of Fire Island customers are more likely to experience revenue losses associated with the closure of FIIS to PWC. One PWC rental shop was identified in the FIIS area. However, NPS believes there will be no disproportionate impact on this shop because it is not expected to experience losses and because it was the only rental shop identified in the area.

5.3 ASSESSMENT

After considering the economic impacts of the proposed rule on small entities, this analysis concludes that Alternative A will not have a significant impact on a substantial number of small entities. NPS has made this determination using RFA implementation guidance provided by other agencies (NMFS, 2000; EPA, 1999b; SBA, 1998) and provides the following factual basis for certification:

- Under Alternatives A, total affected company revenue remains unchanged.

In contrast, NPS cannot certify that Alternatives B, C, or the no-action alternative will not have a significant impact on a substantial number of small entities for the following reasons:

- The range of total affected company revenue losses potentially exceeds 3 percent.
- Although SBA data show there are likely over 1,000 small businesses within this industry in the United States (NAICS 532292) (SBA, 2001), the term “substantial number” depends on the context of the action, the problem to be addressed, and the structure of the regulated industry. Given that all 14 small entities are potentially significantly affected, NPS determined that this alternative affects a substantial number of small entities.

As a result, NPS prepared an initial regulatory flexibility analysis (IRFA) below.

5.3.1 Initial Regulatory Flexibility Analysis

Under Section 603(b) of the RFA (as amended), each IRFA is required to address the following points:

- reasons why NPS is considering the rule;
- the objectives and legal basis for the rule;
- the kind and number of small entities to which the rule will apply;
- the projected reporting, record keeping, and other compliance requirements of the rule; and
- all federal rules that may duplicate, overlap, or conflict with the rule.

In addition, Section 603(c) requires a description of any significant alternatives that may reduce the regulatory burden on affected small entities.

Reasons Why the Park Service is Considering the Proposed Rule

Historically, NPS classified PWC with all other water vessels, which allowed people to use PWC when the use of other vessels was permitted by a Superintendent's Compendium. In recognition of its duties under the Organic Act and NPS management policies, as well as increased awareness and public controversy, NPS has reevaluated its methods of PWC regulation.

The Objectives and Legal Basis for the Proposed Rule

Because of new information regarding potential resource impacts, conflicts with other users, and safety concerns, NPS proposed a PWC-specific regulation in 1998 that would prohibit PWC in units of the national park system unless NPS determines that PWC use is appropriate for a specific unit based on that unit's enabling legislation, resources, and values; other visitor uses; and overall management objectives (63 FR 49,312–17, September 15, 1998). During a 60-day comment period, NPS received nearly 20,000 comments on this proposed regulation. As a result of public comments and further review, NPS promulgated an amended regulation in March 2000 allowing NPS to permit PWC use in 11 units by promulgating a special regulation and in an additional 10 units by amending the Superintendent's Compendiums (36 CFR 3.24[b], 2000). The March 2002 regulation provided park units a 2-year grace period in which PWC use could continue after which time PWC would be banned from any park that took no action to promulgate either PWC-specific regulations or to regulate PWC use in the Superintendent's Compendium. On August 31, 2000, Bluewater Network et al. filed a complaint with the United States District Court for the District of Columbia against NPS alleging, among other things, that the NPS rule-making decisions to allow PWC use in some park units after 2002 by making entries in Superintendent's Compendiums would not provide the opportunity for public input. In addition, the environmental group claimed that because PWC cause water and air pollution, generate noise, and pose public safety threats, NPS acted arbitrarily and capriciously when making its September 1998 and March 2000 decisions.

The District Court signed a settlement agreement between NPS and Bluewater Network on April 12, 2001. The agreement requires all

park units wishing to continue PWC use to promulgate special regulations only after each unit conducts an environmental analysis in accordance with the 1969 NEPA. At a minimum, the NEPA analysis must evaluate the impacts of PWC on water quality, air quality, soundscapes, wildlife, wildlife habitat, shoreline vegetation, visitor conflicts, and visitor safety. In addition NPS is required by federal statutes, including Executive Order 12866, to conduct a benefit-cost analysis of the proposed regulation and analyze the impact of the regulation on small businesses under the RFA of 1980.

The Kind and Number of Small Entities to Which the Proposed Rule Will Apply

The proposed rule applies to numerous potentially affected PWC sales, rental, and service shops; resorts supplying lodging; restaurants; gas; and other retail, each having \$5 million or less in annual sales. NPS estimates that the proposed rule could potentially affect all of these entities, but NPS has limited financial information for the affected entities.

The Projected Reporting, Record Keeping, and Other Compliance Requirements of the Proposed Rule

There are no reporting, record keeping, or other compliance requirements for the proposed rule.

All Federal Rules that May Duplicate, Overlap, or Conflict with the Proposed Rule

NPS is unaware of any federal rules that either duplicate, overlap, or conflict with the proposed rule.

Alternatives

As noted above, NPS analyzed four alternatives for PWC restrictions. The initial screening analysis shows that compared to the no-action alternative, potential impacts are mitigated under Alternatives A, B, and C.

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Appendix A: Social Benefits and Costs of Personal Watercraft Restrictions

The purpose of benefit-cost analysis is to evaluate the social welfare implications of a proposed action—in this case the regulation of PWC use in national parks. That is, it assesses whether the action generates benefits to society (gains in social welfare) that are greater than the costs (losses in social welfare). The following sections provide detailed descriptions of the range of social benefits and social costs that may result from PWC restrictions and discuss the ways in which these benefits and costs can be conceptualized and measured.

A.1 SOCIAL BENEFITS OF PWC RESTRICTIONS

PWC use in national parks may be associated with a number of negative impacts on environmental resources and ecosystems. One result of any negative impacts that occur is that they impose welfare losses on individuals who value the parks' environmental systems. The benefits of PWC restrictions can therefore be thought of and measured as the reduction in these losses to society. In addition, PWC use can negatively affect society in ways that are not directly related to the environment; therefore, the benefits of PWC restrictions must also include reductions in these nonenvironmental losses. Both broad categories of benefits—environmental and nonenvironmental—are discussed in more detail below.

A.1.1 Environmental Benefits

The use of PWC may have adverse impacts on the aesthetic qualities of the park, on human health, and on the park's ecosystems. The benefits associated with avoiding these impacts are described below.

Aesthetic Benefits

Among the largest and most directly damaging impacts associated with PWC use in national parks are its effects on the aesthetic qualities of park air and specifically the park soundscape. The natural soundscape is considered a natural resource of the park, and NPS attempts to prevent or minimize unnatural sounds that adversely affect the natural soundscape. National parks are especially valued for their pristine and undisturbed environments, which are often experienced by visitors through natural vistas and through the relative absence of visible or audible human activity (NPS, 2000b). The improvement or preservation of these aesthetic qualities, either in the form of reduced noise pollution or improved visibility, is therefore a potentially important source of benefits from reducing PWC use.

Noise Reduction. Perhaps the most noticeable and intrusive aspect of PWC is the level of sound they emit during normal operation. PWC have been measured to emit 65 to 105 decibels (dB) per unit, which may disturb visitors on the land and on the water. Noise limits established by NPS require vessels to operate at less than 82 dB at 82 feet (from the shoreline). The amount of noise from a PWC can vary considerably depending on its distance from another park visitor and whether it is in the water or in the air. Noise dissipates by 5 dBs for each doubling of distance from a 20-foot circle around the source and a PWC that is airborne is 15dBA louder than one that is in the water (Komanoff and Shaw, 2000). To put these noise-level estimates into perspective, Table A-1 also compares them with those of other familiar sounds.

PWC users tend to operate close to shore, to operate in confined areas, and to travel in groups, making noise more noticeable to other recreationists. Noise impacts from PWC use are caused by frequent changes in pitch and loudness due to rapid acceleration, deceleration, and change of direction. PWC noise intrudes in

Table A-1. Comparative Noise Emissions

Source	Decibel Level
Firearms	140
Motorcycle	90–110
Snowmobiles	73–100
Vacuum cleaner	70
PWC	65–105
Normal conversation	60
Normal breathing	10

otherwise quiet soundscapes, such as in secluded lakes, coves, river corridors, and backwater areas. Also, PWC use in areas where there are nonmotorized users (such as canoeists, sailors, and kayakers) causes conflicts between users.

Those who are most likely to benefit from reductions in PWC-related noise pollution in national parks are other park visitors and recreators, in particular those engaged in recreational activities that take place by the water, such as fishing, hiking, birdwatching, canoeing, kayaking, and swimming.

Several studies have shown that noise from motorized vehicles diminishes the recreational experience of other users. Several studies have found disamenities associated with various forms of mechanized recreational activities or other “technology-related” noises in recreation areas (Beal, 1994; Ivy, Stewart, and Lue, 1992; Bury and Luckenbach, 1983; Baldwin, 1970; Bury, Wendling, and McCool, 1976; Dunn, 1970; Lucas and Stankey, 1974; O’Riordan, 1977; Sheridan, 1979; Wagar, 1977).

Relatively few studies have specifically estimated the (negative) value of noise externalities on other recreators. One exception is a recent analysis conducted by the Federal Aviation Administration (FAA) to estimate the benefits of a regulation to restrict commercial air tours in Grand Canyon National Park (GRCA) (FAA, 2000). Using visitor-day value estimates from existing studies ranging from \$37 to \$92 (for backcountry, river, and other users of the park), the analysis assumed that these visitor-day values would be reduced in

relation to the how much aircraft noise interfered with the enjoyment of GRCA. Information about how aircraft noise affected different recreators was provided by a separate survey study of GRCA visitors. The survey found, for example, that for backcountry visitors 21 percent were “slightly” affected and 2.5 percent were “extremely” affected by the aircraft noise. In the FAA analysis, visitor value-days were assumed to be reduced by 20 to 80 percent depending on the percentage of respondents who indicated that their enjoyment of the park was “slightly,” “moderately,” “very,” or “extremely” affected by the noise.

Another example of such a study that focuses specifically on the noise impacts of PWC is one that has examined the losses that PWC users impose on other beach recreators (Komanoff and Shaw, 2000). This study assumed that an average beach day (per person) is worth between \$10 for a popular beach and \$30 for a secluded one and that each 10 dB increase in background noise decreases these values by 10 percent. The assumptions about the size of the decrease in value from increases in noise come from studies on the increased property values for houses in quiet neighborhoods. Assuming also that each 1 dB noise level increment reduces the value of a beach day by 1 percent, the study found that beachgoers suffer an average loss in recreation value of between \$0.50 and \$7.40 per jet ski cluster (1.6 jet skis over the course of a day) per person per day.

Other evidence regarding the noise-related losses imposed by PWC can be gleaned from studies that have examined the effects of congestion on recreation values. In these studies, congestion is often measured as the number of encounters with other recreators, which may be thought of as being roughly equivalent to hearing the sound of PWC. For example, in a study of backcountry recreators in the Caribou-Speckled Mountain Wilderness in Maine, Michael and Reiling (1997) found that weekend visitors experienced losses of \$22.3 (in 1990 dollars) per visit if they encountered more groups than expected.

Visibility Improvements. Several studies by the NPS and others have demonstrated the importance of visual air quality for visitors’ (and nonvisitors’) enjoyment and appreciation of national parks. Nevertheless, visual air quality has been and continues to be threatened at many national parks across the country. Emissions

from PWC in these parks are one of many potential (albeit, a relatively small) sources of these visibility impairments.

Although visibility effects can be characterized and measured in several different ways, “regional haze,” which uniformly reduces visual range and therefore impairs the appreciation of natural vistas, has been a particular source of concern. The primary contributors to regional haze and visibility impairments in general are small particles (particulate matter or PM) in the atmosphere that scatter and absorb light. There are several different sources and types of particles in the environment; however, sulfates (and to a lesser extent nitrates), primarily from the combustion of fuels, are the largest contributors to visibility reduction, especially in the eastern portions of the U.S. (Malm, 1999). Nationwide, the largest sources of sulfur dioxide emissions that contribute to sulfates in the atmosphere are power plants and other industrial sources. Mobile sources, such as cars, trucks, and buses (and PWC), account for the largest portion of NO_x emissions, which contribute to nitrates.

Emissions factors per hour are not available for PWC but because PWC are powered by the same type (two-stroke) of engine as snowmobiles, snowmobile emissions factors may serve as a reasonable proxy. Table A-2 compares typical emissions rates for snowmobiles and other vehicles for NO_x and PM. These are the pollutants that are the most likely contributors to visibility impairments from PWC emissions. These emissions rates vary greatly across types and uses of these vehicles; however, the table shows that PM emissions for snowmobiles are particularly high relative to automobiles. The California Air Resources Board found that a 7-hour ride on a PWC powered by a conventional two-stroke engine produces the same amount of smog-forming emissions as over 100,000 miles driven in a modern passenger car. It should also be noted, however, that automobiles account for a very small portion of PM emissions nationwide.

The estimates in Table A-2 suggest that PWC can be a source of visibility impairment in national parks, but their contribution to overall levels of regional haze in these areas is likely to be negligible. Nevertheless, in high-use areas and periods, they may negatively affect visual air quality in a noticeable way.

Table A-2. Comparative Emissions Factors for Snowmobiles and Other Vehicles: NO_x and PM

	NO _x	PM
Snowmobiles (lbs per 4 hr visit)	0.06	0.2
Automobiles (lbs per 4 hr drive ^a)	0.09–0.41	0.02
Diesel buses (lbs per 4 hr drive ^a)	3.22	0.26

^aAssuming an average speed of 25 mph.

Source: National Park Service (NPS). February 2000a. *Air Quality Concerns Related to Snowmobile Usage in National Parks*. Denver, CO.

Several studies have investigated U.S. households' values for improvements in visibility at various national parks across the country. All of these studies have found a significant WTP by both users and nonusers for visibility improvements. One study in particular (Chestnut and Rowe, 1990) found that the average household in the southeast U.S. would be willing to pay \$68 (in 1999 dollars) per year for a doubling of the visual range in national parks in the southeast U.S.

Human Health Benefits

In addition to NO_x, ozone, and PM, PWC emissions typically contain a number of other pollutants, including CO, a conventional air pollutant that is commonly associated with mobile sources. It also includes a number of potentially toxic HC pollutants—benzene, 1,2-butadiene, formaldehyde, and acetaldehyde—and ammonia. As described in Table A-3, inhalation of these pollutants is associated with a wide variety of potential adverse health effects.

The extent to which the health effects listed in Table A-3 result from PWC emissions depends on the level and duration of exposure. Unfortunately, there is too little data and too much uncertainty to reliably estimate the incidence of these health effects. For comparative purposes, however, Table A-4 compares emissions rates of HCs and CO for snowmobiles (as in Table A-2, snowmobile emissions factors serve as a proxy for those of PWC) and for other vehicles.

The comparisons for CO are particularly relevant since highway vehicles account for over 50 percent of total CO emissions in the country (EPA, 2000b). Although the measures of vehicle use in the emissions factors are different across vehicles, the rates of HC and

Table A-3. Health Effects Associated with Pollutants in PWC Emissions

	Carcinogenic Effects	Other Chronic Health Effects	Acute Health Effects
Particulate matter (PM)	None	Chronic bronchitis	High-level exposure: mortality, acute bronchitis Low-level exposure: cough
Carbon monoxide (CO)	None	Aggravation of cardiovascular disease	High-level exposure: visual and mental impairment
Nitrogen oxides (NO _x)	None	Reduced pulmonary function	High-level exposure: cough, fatigue, nausea Low-level exposure: lung irritation
Benzene	Known human carcinogen	Anemia and immunological disorders	High-level exposure: dizziness, headaches, tremors
1,3-Budatdiene	Probable human carcinogen	Birth defects, kidney and liver disease	High-level exposure: neurological damage, nausea, headache Low-level exposure: eye, nose, throat irritation
Formaldehyde	Probable human carcinogen	NA	NA
Acetaldehyde	Possible human carcinogen	Anemia	High-level exposure: pulmonary edema, necrosis Low-level exposure: eye, skin, lung irritation
Ammonia	None	NA	High-level exposure: eye and lung irritation

NA = Not available

Sources: U.S. Environmental Protection Agency (EPA). Integrated Risk Information System. <<http://www.epa.gov/ngispgm3/iris/index.htm>>. As obtained on October 15, 2000a.U.S. Environmental Protection Agency (EPA). 1999a. *1997 National Air Quality: Status and Trends*. Washington, DC: Office of Air and Radiation.**Table A-4. Comparative Emissions Factors for Snowmobiles and Other Vehicles: HC and CO**

	HC	CO
Snowmobiles (lbs per 4 hr visit)	19.84	54.45
Automobiles (lbs per 4 hr drive ^a)	0.09–0.44	0.75–3.24
Diesel buses (lbs per 4 hr drive ^a)	1.23	4.45

^aAssuming an average speed of 25 mph.Source: National Park Service (NPS). February 2000a. *Air Quality Concerns Related to Snowmobile Usage in National Parks*. Denver, CO.

CO emissions for snowmobiles are distinctly higher than for automobiles and diesel buses. As a result, national park visitors recreating near areas where PWC use is permitted may be exposed to particularly high levels of CO and certain HCs.

Restrictions on PWC use in national parks could potentially reduce harmful exposures to park visitors and workers, particularly for individuals who spend extended periods in high-use areas. The benefits of these restrictions can be expressed as the value of reductions in the incidence (i.e., the number of cases avoided) of harmful health effects, in particular those effects described in Table A-3. As previously mentioned, the total number of avoided health effects is not known; however, using information from a recent EPA study of the benefits of air pollution regulations (EPA, 1997), Table A-5 provides a summary of “unit” values for selected health effects. Based on a review and synthesis of several health valuation studies, these values represent best estimates of individuals’ average WTP to avoid a single case of the health effect. In the absence of more complete information on the total health benefits of reducing PWC use, these values provide a rough sense of the magnitude and relative size of the benefits associated with avoiding specific health effects that may result from acute exposures.

Table A-5. Unit Values for Selected Health Effects

Health Effect	Unit Value (mean estimate) (1999\$) ^a
Acute bronchitis	\$57
Acute asthma	\$41
Acute respiratory symptoms	\$23
Shortness of breath (one day)	\$6.8

^aAll amounts inflated using the consumer price index available from the Bureau of Labor Statistics (<<http://146.142.4.24/cgi-bin/surveymost>>).

Ecosystem Protection Benefits

PWC have the potential to damage park ecosystems because of the emissions and noise associated with their use. To the extent that these types of damages to park ecosystems occur, their cumulative effect is to reduce the “ecological services” that these systems

provide to individuals and households across the country. National park ecosystems are particularly valued for their unique biological, cultural, and geological resources and the recreational and other services they provide. A vast majority of park visitors (i.e., users) experience and enjoy the natural systems of the park through a wide variety of recreational activities (wildlife viewing, hiking, fishing, as well as using PWC). However, even individuals who are not park visitors (i.e., nonusers) can benefit from the knowledge that park resources are being protected and preserved. These nonuse values can stem from the desire to ensure others' enjoyment (both current and future generations) or from a sense that these resources have some intrinsic value. Evidence of such nonuse values for park protection is provided in studies that have documented significant WTP by nonusers for improved air quality at parks (e.g., Chestnut and Rowe, 1990) and, more generally, for the protection of unique species and ecosystems (see, for example, Pearce and Moran [1994] for a review of such studies). Restrictions on PWC use in national parks can therefore provide benefits to both users and nonusers in a number of ways by protecting the parks' ecological resources.

A.1.2 Nonenvironmental Benefits

Restrictions on PWC use in national parks can also improve societal welfare in ways that are not directly related to environmental quality in and around the parks. These potential nonenvironmental benefits are described below.

Public Safety Benefits

With the increase in PWC use in recent years has come an increased concern relating to the health and safety of operators, swimmers, snorkels, divers, and other boaters. A study conducted by the National Transportation Safety Board (NTSB) in 1998 revealed that although recreational boating fatalities have been declining, PWC related fatalities have increased in recent years (NTSB, 1998). PWC accident statistics provided by the U.S. Coast Guard supports the increase in PWC-related fatalities. Within the U.S. five PWC-related fatalities occurred in 1987 and 68 PWC-related fatalities occurred in 2000. However, the peak occurred in 1997, with 84 PWC-related fatalities. Since 1997, PWC-related accidents, injuries, and fatalities have decreased. Following this

same pattern, the percentage of PWC out of all boats involved in accidents have decreased from 36.3 percent in 1996 to 29.6 percent in 2000. The increases and decreases in PWC accidents, injuries, and fatalities are comparative to the number of PWC sales and number of PWC owned (Schmidt, 2001).

Restrictions on PWC use in national parks would certainly reduce the number of such incidents in the parks.¹ The primary beneficiaries would be the PWC users themselves, whose safety would be protected; however, these benefits may be implicitly accounted for in the consumer surplus changes (see Section A.2) that these recreators experience as a result of the restrictions.² Other summer recreators (non-PWC) might also benefit if they would otherwise be at risk of being involved in accidents with PWC. In addition, PWC accidents can impose costs on NPS and other local state and local government agencies that are responsible for providing medical, rescue, and related assistance. Reductions in PWC accidents in national parks would therefore allow some of the resources devoted to these activities to be diverted to other publicly beneficial uses.

Avoided Infrastructure Costs

Allowing PWC in national parks requires NPS to develop, maintain, and operate an infrastructure to support these activities. In particular launch sites and buoys must be designated, maintained, and monitored. The costs associated with these activities vary widely across parks, depending on the physical characteristics of the parks and the level of PWC use permitted.

By restricting PWC use, some of these infrastructure-related costs can be avoided or reduced. As a result some of the resources devoted to these activities can also be diverted to other publicly beneficial uses.

¹The benefits of these reductions may be offset to some degree by increased PWC usage and accidents in areas outside the parks.

²To the extent that PWC users are aware of the safety risks they face, the potential losses to themselves from accidents should already be factored into their consumer surplus from using a PWC. This implies that the safety benefits to these individuals from reducing PWC use are implicitly accounted for (i.e., deducted from) the consumer surplus losses to these recreators.

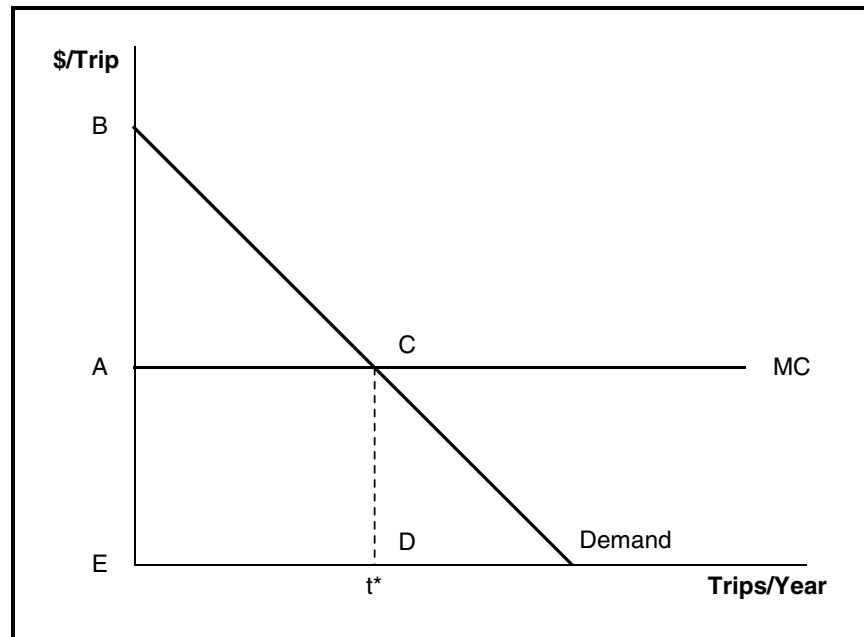
A.2 SOCIAL COSTS OF PWC RESTRICTIONS

The primary losses associated with PWC use restrictions in national parks will accrue to

- PWC users, in particular individuals who will not PWC in the park as a direct result of the restrictions, and
- providers of PWC-related services for park visitors.

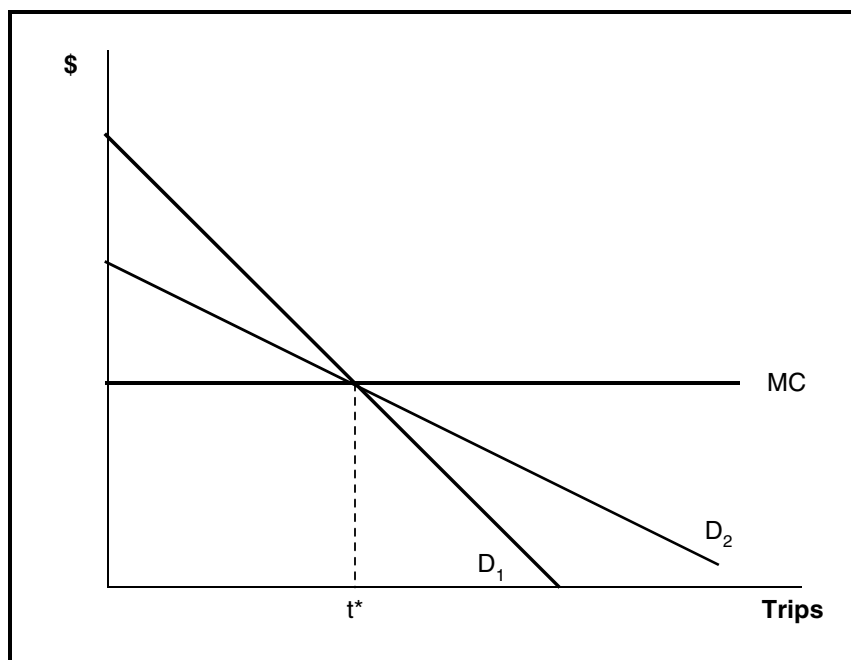
The welfare losses to individual consumers (PWC riders) are measured by their loss in consumer surplus. Consumer surplus is measured as the difference between the total cost of a product or activity to the consumer and the total amount the individual would be willing to pay for that activity. In the context of recreation activities, Figure A-1 depicts an individual demand curve for PWC trips, the marginal cost of a trip (MC, assumed to be constant), and the optimal number of trips per year, t^* . The triangle ABC measures the consumer surplus associated with this optimal number of trips—the difference between what the individual paid for the trips, ACDE, and the total WTP for the trips (the area underneath the demand curve), EBCD.

Figure A-1. Consumer Surplus



The extent of the welfare loss to an individual rider depends crucially on the availability of substitute activities. Figure A-2 depicts two alternative demand curves for PWC trips to a particular waterbody. The slope of the demand curve reflects the number of substitute activities available to a particular individual and the preferences of that individual toward those substitutes. The flatter demand curve, D_2 , indicates that this individual has a variety of close substitutes for PWC use in this area (these substitutes could include PWC riding in a different area or participating in a different activity such as motorboating). The individual with the steeper demand curve, D_1 , has fewer substitute activities he/she enjoys as much as using his/her PWC in this waterbody. If both individuals choose the same number of trips, as in Figure A-2, the person with the steeper demand curve, D_1 (fewer substitutes for PWC use) receives greater consumer surplus from use in this particular waterbody and thus will experience a greater loss in welfare if the waterbody is closed.

Figure A-2. Consumer Surplus and Substitute Activities



The change in welfare for businesses is measured by producer surplus, or the area AP^*B in Figure A-3, where P^* is the market price of the good, for example a PWC rental. Producer surplus measures the difference between total revenue and variable costs. If the firms face an upward-sloping marginal variable cost (MC) curve, then a decrease in demand, indicated in Figure A-4 from D to D' will result in a lower producer surplus for PWC rental companies.

If PWC riding decreases as a result of the regulation, then the suppliers of PWC and other tourism-related services will be affected, including rentals and sales of PWC and PWC accessories, lodging, meals, and other tourism-related expenditures. If demand for other types of recreation related rentals increases, then some businesses may experience an offsetting increase in producer surplus.

Figure A-3. Producer Surplus

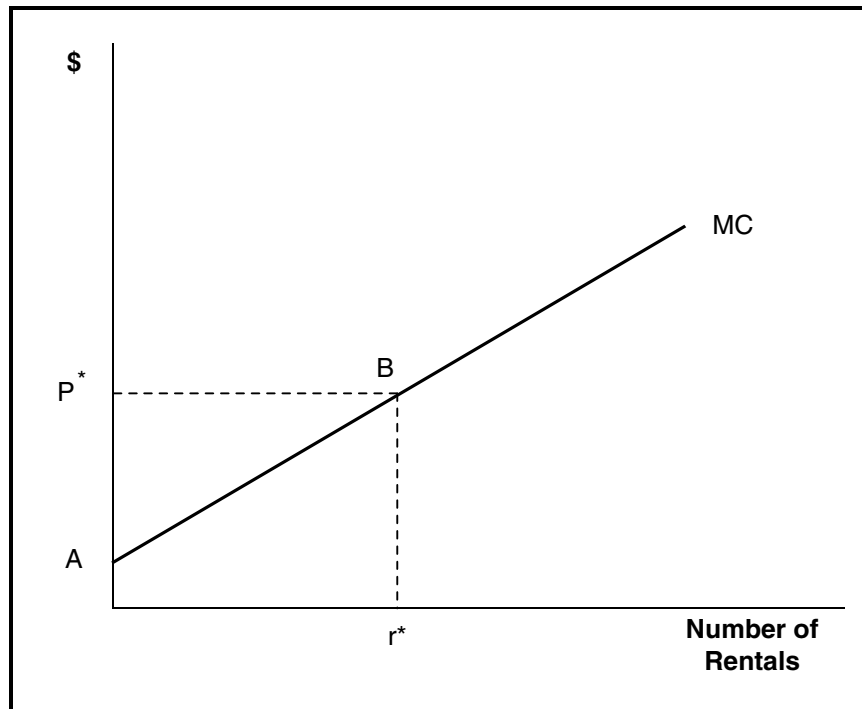


Figure A-4. Producer Surplus and a Change in Demand

